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City Biodiversity Index – Siliguri

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Contact
ICLEI-Local Governments for Sustainability, South Asia
C-3 Lower Ground Floor, Green Park Extension, New Delhi-110016
Tel: +91–11–4974 7200; Email: iclei-southasia@iclei.org

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Abbreviations

BMC	Biodiversity Management Committee
CAGR	Compound Annual Growth Rate
CapaCITIES	Capacity Building on Low Carbon and Climate Resilient City Development in India
CBD	Convention on Biological Diversity
CBI	City Biodiversity Index
CBSE	Central Board of Secondary Education
CDP	City Development Plan
c-hed	Centre for Heritage, Environment and Development
COP	Conference of the Parties
DDP	Draft Development Plan
E	East
GoI	Government of India
GoWB	Government of West Bengal
ha	Hectare
ICLEI South Asia	ICLEI - Local Governments for Sustainability, South Asia
ICSE	Indian Certificate of Secondary Education
INR	Indian Rupees
km	Kilometre
LBSAP	Local Biodiversity Strategy and Action Plan
m	metre
mm	Millimeter
MMIC	Member Mayor in Council
MoUD	Ministry of Urban Development
N	North
NBDD	North Bengal Development Department
NGO	Non Government Organisation
NP	National Park
NParks	Singapore National Parks Department
°C	Degree Celsius
PBR	People's Biodiversity Register
SDC	Swiss Agency for Development and Cooperation
SI	Singapore Index
SJDA	Siliguri Jalpaiguri Development Authority
SJPA	Siliguri Jalpaiguri Planning Authority
SMC	Siliguri Municipal Corporation
sq km	Square Kilometre
ULB	Urban Local Body
WLS	Wildlife Sanctuary

Section A: About City Biodiversity Index

In 2008 at CBD COP 9, in order to address the absence of a single, urban, local biodiversity index, Singapore's Minister for National Development at the time, Mr. Mah Bow Tan, proposed for the establishment of a City Biodiversity Index (CBI) to benchmark biodiversity conservation efforts of cities.

Developed and maintained by the Singapore National Parks Department (NParks), with support from ICLEI, the CBD and others, the CBI is the only biodiversity index designed specifically for monitoring and evaluating biodiversity in cities. The index is also called the 'Singapore Index (SI)', so named in recognition of Singapore's contribution and leadership.

It is a self-assessment tool for cities to evaluate and monitor the progress of their biodiversity conservation efforts against their own individual baselines. It comprises: a) the "Profile of the City", which provides background information on the city; and b) the 23 indicators that measure native biodiversity, ecosystem services provided by biodiversity, and governance and management of biodiversity based on guidelines and methodology provided in the User's Manual on the Singapore Index on Cities ' Biodiversity.

The scoring of the Singapore Index is quantitative in nature. Each indicator is assigned a scoring range between zero and four points, with a total possible maximum score of 92 points. The year in which a city first embarks on this scoring will be taken as the baseline year, and this will be measured against future applications of the Index to chart its progress in conserving biodiversity[1].

1. Secretariat of the Convention on Biological Diversity. (2014). City Biodiversity Index. User's manual on the Singapore Index on Cities' Biodiversity (also known as the city biodiversity index). Available from: http://www.cbd.int/en/ subnational/partners-and-initiatives/city-biodiversity-index. [Accessed, 21 January 2020]

Summary of the Scores

The city scored a total of 32 out of 72 for 18 indicators (Figure 1). Since this was the baseline year the indicators 4-8 were not considered in the analysis, thus reducing the maximum possible score to 72.

- The first section on "Native Biodiversity in the City", contributed to an average score of 10 out of 20 as only 5 indicators were taken into consideration. This score is mainly because of the riverine ecosystem of the city.
- Indicators 11-14 which relate to "Ecosystem Services Provided by Biodiversity in the City" have minimally contributed to the overall score, scoring 5 out of a possible 16 points. This section is linked with the first section and reflects the biodiversity health of the city.
- Indicators 15-23 which correspond to "Governance and Management of Biodiversity in the City" received a score of 17 out of 36 points. The reason behind this is the fact that the city takes active role in biodiversity related issues and activities and also partners with a wide array of NGOs for the same.

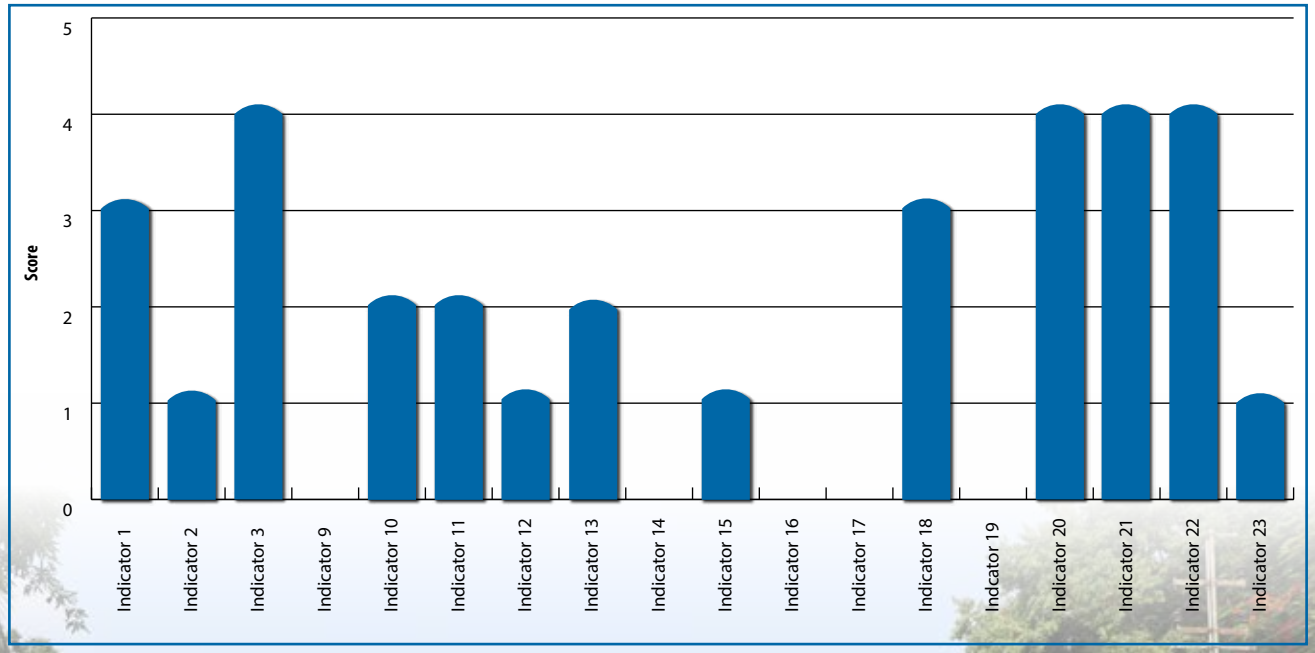

Figure 1: Siliguri City Biodiversity Index 2020 at a Glance

Section B: City Biodiversity Index of Siliguri

Part A: City Profile

Location

Siliguri is located in the Darjeeling and Jalpaiguri districts of West Bengal, India (Figure 2) between 26°4°'41"N - 26°47'32"N latitude and 88°23'48"E - 88°27'48"E longitude within the Siliguri Jalpaiguri Planning Area[2] (SJPA) (Figure 2 and Figure 3). There are 47 wards in Siliguri, 33 of which lie within Darjeeling district and 14 wards in Jalpaiguri district (Figure 4).

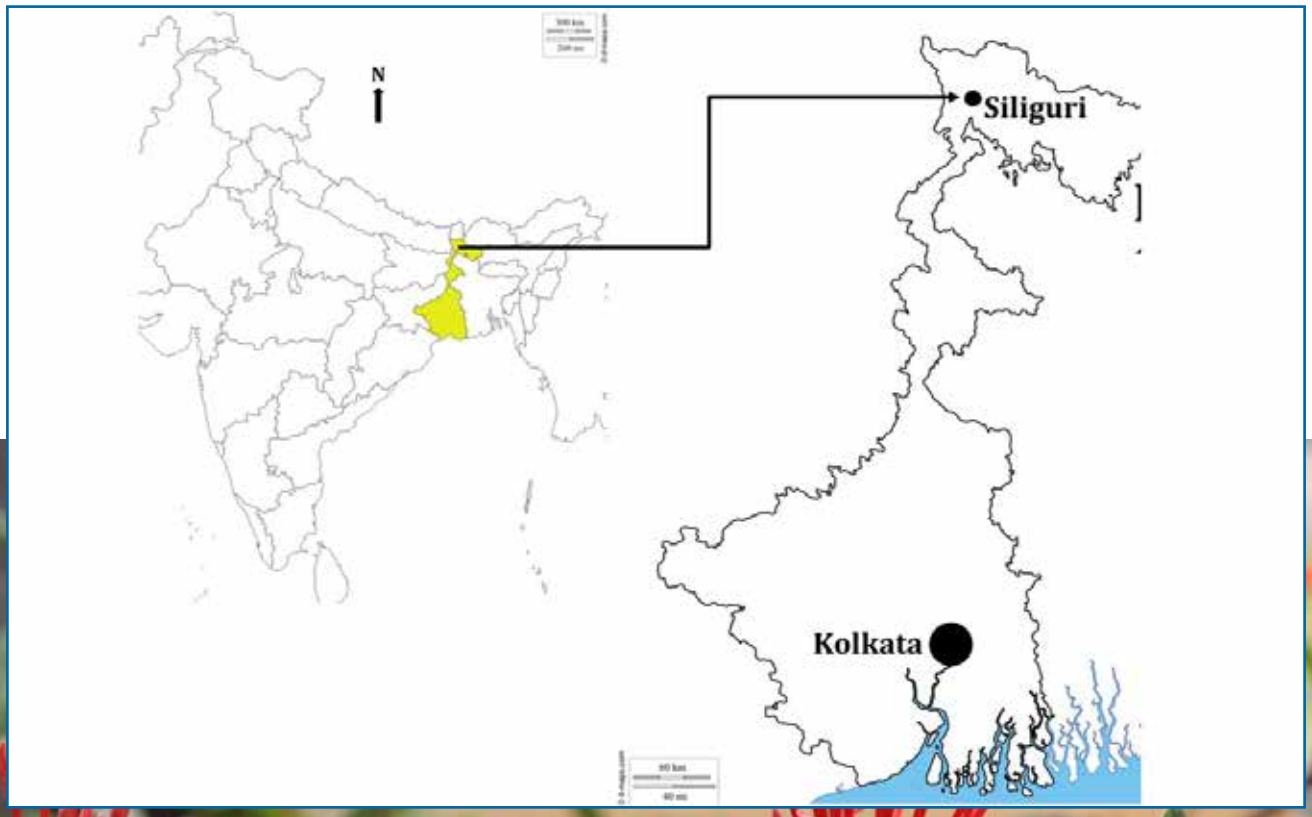

Figure 2: Location map of Siliguri

2. Siliguri Jalpaiguri Planning Area is administrated by the Siliguri Jalpaiguri Development Authority. It encompasses an area of approximately 1330 sq km, and houses a 1.58 million population, of which 0.59 million are urban.

Figure 3: Delineation of the Siliguri Jalpaiguri Planning Area[3]

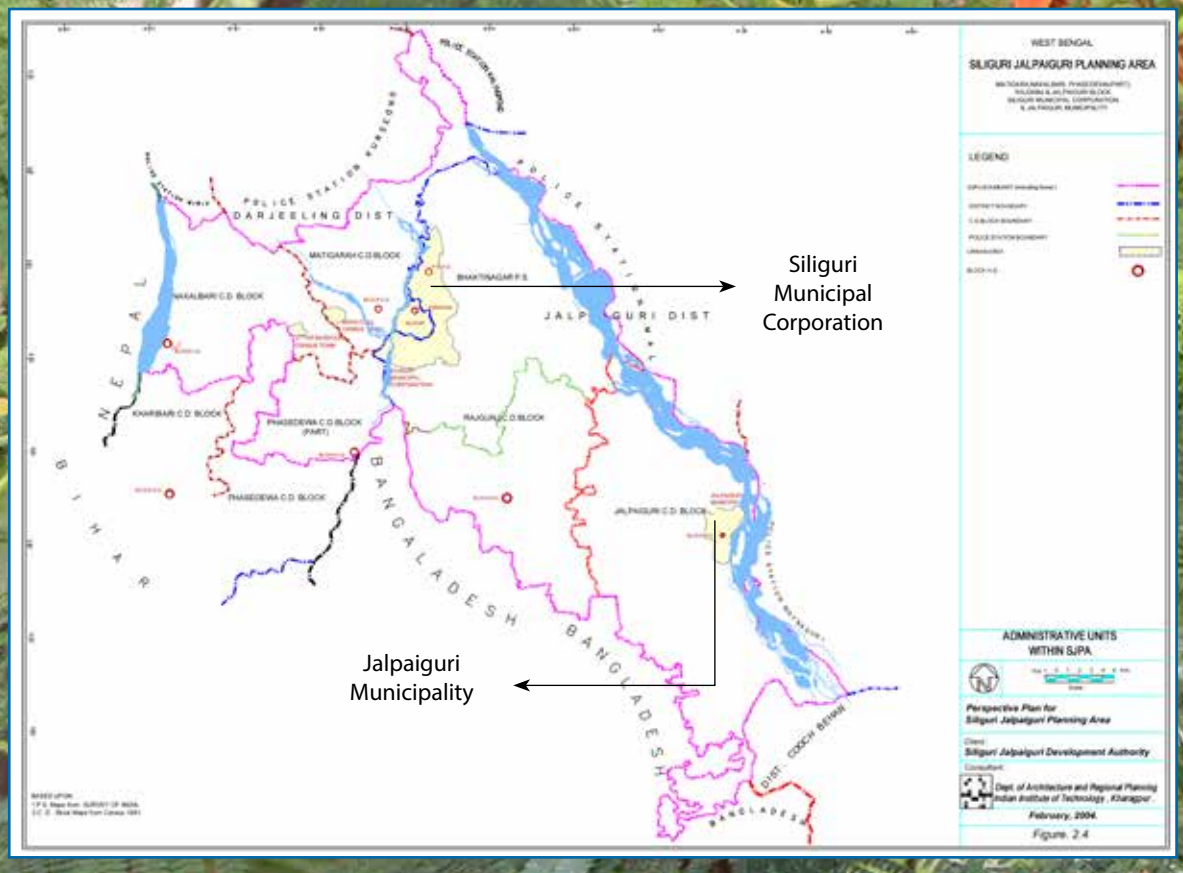

Figure 4: Location of Siliguri within the SJPA[4]

3. Siliguri Jalpaiguri Development Authority. 2004. Perspective Plan 2025: Siliguri Jalpaiguri Planning Area
4. Ibid

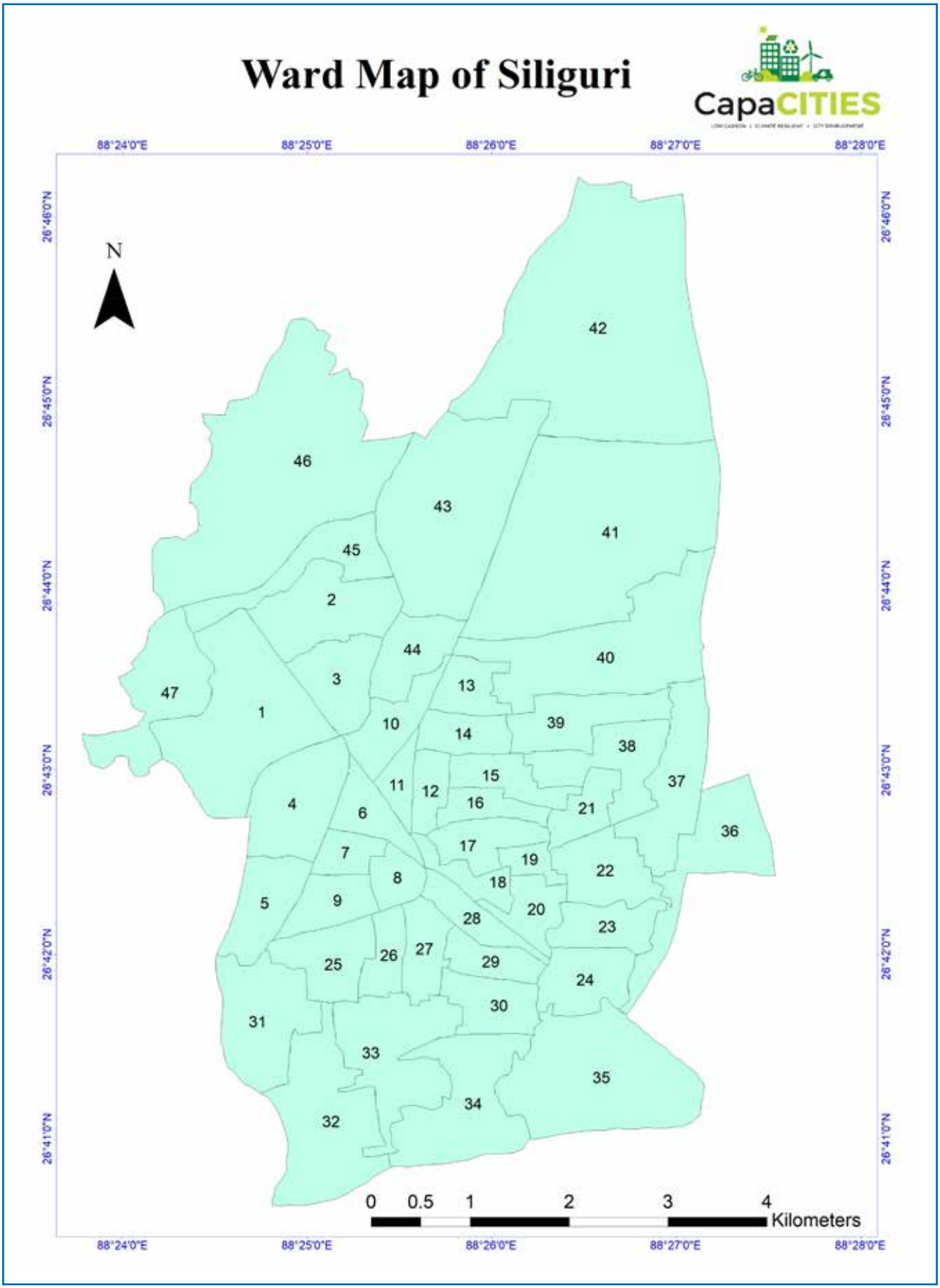

Figure 5: Ward Map of Siliguri

Climate

Siliguri experiences a subtropical humid type of climate, characterised by three distinct seasons of hot and humid summer, mild winter and intense monsoon. The summer season extends from March to June. The season is mild with average maximum temperature below 35°C due to the city's location on the foothills of Himalayas. The hottest days of the season fall in the months of May and June. The winter months (December to February) are relatively cool, usually accompanied with dense fog and light rain with average temperature ranging from 3°C to 15°C. The monsoon season extends from mid-June to September, with the heaviest rainfall occurring in the months of July and August. Intense rainfall up to 200 mm per day has been recorded during this period in the past. The annual average rainfall in Siliguri ranges between 2600 mm to 4000 mm. The difference in precipitation between the driest month and the wettest month is 902 mm. The relative humidity during the monsoons ranges from 80% to 83%.

Physical Features of the City

Siliguri stretches across the floodplains of the Mahananda River in the foothills of the Eastern Himalayas in North Bengal[5], and is surrounded by dense forests in the northern and eastern sides. The average elevation in the city is around 122 m or 400 feet above mean sea level. The city is strategically located in the area known as Chicken Neck Corridor, an important link connecting the states in North East India and the neighbouring countries with rest of India. Siliguri is a vital link to the North East of India because there is no alternative transport mode by land to reach Guwahati (Assam) and ultimately to the rest of the region, other than via Siliguri[6]. Hence the region is also referred as the 'Doors to Northeast India'. Owing to this strategic location Siliguri has emerged as a commercial nerve centre of the SJPA.

Demographics

Siliguri has grown gradually from a small village with a population of only 784 in 1901 into a Class I city with population of over half a million in 2011. Some demographic characteristics of the city as of 2011 are given in Table 1.

Table 1: Demographic characteristics of Siliguri (2011)[7, 8]

	Siliguri in Darjeeling district	Siliguri in Jalpaiguri district	Siliguri Total
Area (sq km)	20.1	21.8	41.9
Households	66,062	49,895	115,957
Population	294,546	218,718	513,264
Average household size	4.4	4.4	4.4
Population density (per sq km)	14,654	10,033	12,250
Male population	151,535	112,167	263,702
Female population	143,011	106,551	249,562
Sex ratio	944	950	946
Literacy rate (%)	78	76	77

5. The State of Bengal's seven districts, namely, Cooch Behar, Alipurduar, Jalpaiguri, Darjeeling, North Dinajpur, South Dinajpur, and Malda are collectively referred to as North Bengal. (Source: http://wbnorthbengaldev.gov.in/htmlpage/index.aspx - accessed: 09.02.2017)
6. Air connectivity is an alternate mode to reach Assam, but due to its high cost per km it has not yet emerged as a prevalent mode of transport.
7. Directorate of Census Operations, GoWB. 2011. District Census Handbook for Darjeeling
8. Directorate of Census Operations, GoWB. 2011. District Census Handbook for Jalpaiguri

The population growth rate of Siliguri has fluctuated from being exceptionally high to being relatively unchanging (Table 2). Post partition in 1947, due to influx of refugees from erstwhile East Bengal, Siliguri recorded (in 1951) a population boom which corresponded to a CAGR of over 11%. By 1991, the growth rate gradually went down to 3.5% per annum. During 1991-2001, the city population experienced a high growth rate, for the second time after 1947, due to the upgradation of Siliguri from a municipality to a Municipal Corporation in 1994[9].

Table 2: Population growth rate pattern of Siliguri (1951 to 2011)[10]

Year	Population	Area (sq km)	Population Density (per sq km)	CAGR (%)	Number of Wards	Remarks
1951	32,480	9.32	3,485	11.97	-	Post-independence migration due to partition.
1961	65,471	15.54	4,213	7.26	7	The population growth between 1951-1981 is on account of the migration due to civil war of 1960, Indo-China and Indo-Pak wars of 1962 and 1971 respectively.
1971	97,484	15.54	6,273	4.06	12	
1981	153,825	15.54	9,899	4.67	19	
1991	216,950	15.54	13,961	3.50	30	Self-induced growth.
2001	472,374	41.90	11,274	8.09	47	Upgradation of Siliguri from Municipality to Corporation led to the population growth as more areas were included within the municipal boundary.
2011	513,264	41.90	12,250	0.83	47	Self-induced growth and probably outmigration due to lack of development.

One of the unique features of the city's demography is its high floating population. As stated in the Draft Development Plan[11] (DDP), Siliguri, the daily floating population visiting the city is as high as 150,000 which increases the pressure on the city infrastructure and therefore, needs to be considered in the future interventions.

Population Projection: Based on the trend of growth of population, population projections till the year 2041 is given in Table 3.

Table 3: Population projection for Siliguri (till 2041)[10]

Population	2016	2021	2026	2031	2036	2041
Projected	570,898	659,339	761,480	879,445	1,015,684	1,173,029
Floating	150,000	165,612	182,849	201,880	222,892	246,091

9. Siliguri Jalpaiguri Development Authority. 2013. Detailed Project Report on Sewerage Works - Siliguri Municipal Area.
10. MoUD, GoI and World Bank. 2015. Draft City Sanitation Plan - Siliguri.
11. Siliguri Municipal Corporation. 2007. Draft Development Plan: 2008-09 to 2012-13.

Economic Parameters

Siliguri being the commercial nerve centre of North Bengal, has a large number of trade centres and markets for consumer goods which makes it home to many retailers, wholesalers, dealers, distributors and small-scale entrepreneurs. The city's strategic location makes it a base for essential supplies to the north-east region.

Siliguri's economy is signified by four T's, viz, tea, timber, tourism and transport[12], and its hinterland consists of entire North Bengal, parts of Bihar, Sikkim, and Assam in India and parts of Bhutan, Bangladesh and Nepal (Figure 6). The world famous Darjeeling Tea grows around Siliguri in the hills and the foothills of the Himalayas. The region is also home to a vast, expanse of dense forests which are the primary sources of timber. Siliguri literally serves as the 'doors' to attractive tourist destinations like Bengal's hill stations of Kurseong, Darjeeling, Kalimpong, Mirik and numerous other smaller hamlets; hill stations in the State of Sikkim, and in the countries of Nepal, and Bhutan; and forests (reserved and protected) in the Jalpaiguri and Darjeeling districts of Bengal. The tea, timber and tourism industries are supported and complemented by strong transport and hospitality industries.

Figure 6: Hinterland of Siliguri[10]

Primary activity (also called the primary sector) is not prominent within Siliguri. However, the surrounding areas are home to tea estates, rice fields, pisciculture, vegetable fields and animal husbandry. Siliguri has emerged as the third-most important centre of tea trade in the country[10]. In the secondary sector, Siliguri metropolitan area is fast emerging as the industrial capital of North Bengal, with small scale industries dominating the scene. The leading small scale industry categories in the region are engineering, chemicals, paper, timber and tea. An important component of the manufacturing sector is the cottage industries, which are by and large informal in nature. These units are found in almost all the wards of the Corporation, producing soft toys, envelope, and manufacturing of shola ornaments, bidi and various handicraft

12. MoUD, GoI. 2016. About the Amrut City: Siliguri. PWD (GoWB)

products by the local Self Help Groups. The tertiary sector dominates the economic environment of the Siliguri, primarily trade and commerce, and transportation and hospitality. The tertiary sector of Siliguri includes academic institutions, banks and post offices, health institutions, transportation, hotels, retail outlets and trading centres, and is located along transportation corridors[10].

The major drivers of change in terms of biodiversity within the city are the following:

1. Urbanisation and population growth
2. Land use change (including land conversion, reclamation, encroachment) and associated habitat degradation
3. Weak and ineffective enforcement of laws
4. Human-wildlife conflict
5. Solid waste and effluent discharge

Biodiversity

Siliguri is surrounded by ten major wildlife sanctuaries, national parks and wildlife reserves (Table 4), some of which are interconnected and encompass a wildlife movement corridor, spanning over 200 km.

Table 4: Protected Areas in and around Siliguri[13]

Protected areas	Area (sq km)	Forest Type Group	Distance from Siliguri (km)
Buxa[14]	755.31	7B	170
Chapramari WLS	9.60	7B	70
Jaldapara NP	216.51	7B	130
Jorepokhri WLS	0.04	2C	23
Mahananda WLS	158.04	7B	10
Senchal WLS	38.88	2C	55
Gorumara NP	79.45	7B	74
Neora Valley NP	88.00	2C	100
Singalia NP	78.60	2C	90
Eastern Dooars Elephant Reserve	977.51	7B	150

Since the city is situated in the Terai region at the base of Himalayas, a global biodiversity hotspot, containing numerous rare species of flora and fauna, some of these species are bound to 'spill over' into the outer city limits. The surrounding forests are characterized by their distinct wildlife variety; example Mahananda Wildlife Sanctuary near Siliguri is famous for elephants. Sukna is the gateway to this sanctuary which is 12 km away from Siliguri. The city itself has a dearth of studies on its biodiversity including any detailed species inventory. To further visualize the areas in the city that provide natural habitats for a variety of biodiversity, a natural asset map (as shown in Figure 7) was developed as part of the CBI process under the CapaCITIES project. The river and its associated riverine vegetation, ponds, sparse vegetation, open green spaces and open grounds are the major biodiversity habitats of Siliguri (Table 5).

13. Manoj, K., Bhattacharya, R., and Padhy, P.K. 2013. Forest and Wildlife Scenarios of Northern West Bengal, India: A Review. *International Research Journal of Biological Sciences*. Vol. 2(7). 70-79.
14. Includes Buxa Tiger Reserve, Buxa National Park, and Buxa Wildlife Sanctuary

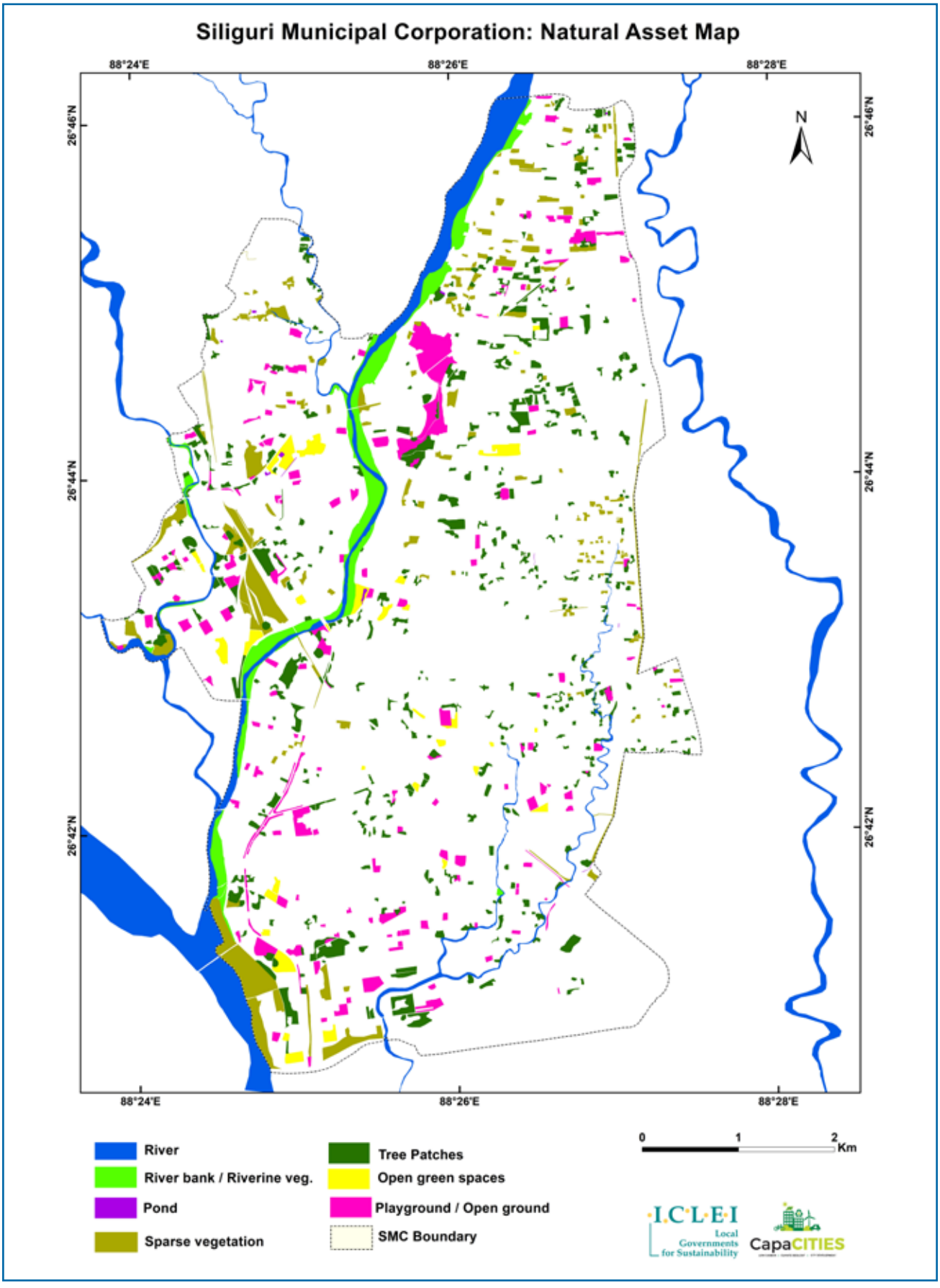

Figure 7: Natural Asset Map

Table 5: Area wise distribution of natural asset category (inside SMC boundary)

Sl. No.	Land Class	Area in Sq. m.
1	Tree patch	1.87
2	Open green spaces	0.39
3	Playground/ parking ground	1.22
4	River	4.38
5	Ponds	0.01
6	River bank / Riverine vegetation	0.86
7	Sparse vegetation	1.45

As per Champion and Seth's classification[15], out of 16 forest types present in India, seven types are found in Siliguri and adjoining areas (Table 6).

Table 6: Forests types in adjoining areas of Siliguri[16]

Group	Forest Type	Distribution in West Bengal	Area (sq. km.)
1B	Northern Tropical Wet Evergreen	Plains of North Bengal up to 150 m altitude	167
2B	Northern Sub Tropical Semi Evergreen	North Bengal Middle Hills	25
3C	North India Moist Deciduous	North Bengal - Dooars and Terai	1,757
4B	Littoral and Swamp - Mangroves	Tidal Mangrove Forests of Sundarban	4,263
4D	Littoral and Swamp - Tropical Seasonal Swamp	Malda, North Dinajpur and South Dinajpur	20
5B	Northern Tropical Dry Deciduous	Bankura, Purulia, Midnapore, Birbhum and Burdwan	4,527
8B	Northern Sub Tropical Broad Leaved Wet Hill	North Bengal Hills - 300 m to 1650 m altitude	800
11B	Northern Montane Wet Temperate	North Bengal Hills - 1650 m to 3000 m altitude	150
12C	East Himalayan Moist Temperate	North Bengal Hills - 1500 m to 1800 m altitude	150
14C	Sub Alpine	North Bengal Hills - 3000 m to 3700 m altitude	20

However, in the immediate vicinity of Siliguri, i.e., within 10 km from the city limits, the prevalence of '3C' - North India Moist Deciduous Forests is observed. Sal occupies about 80% of all vegetation in these forests, and is categorised according to their dominating plant species, viz:

a. East Himalayan Sal Forest present on the lower slopes of Mahananda Wildlife Sanctuary contains *Shorea robusta*, *Acacia catechu*, *Bombax ceiba*, *Dalbergia sissoo*, riverine grasslands and various rare species of plants like orchids
b. East Himalayan Upper Bhabar Sal mainly present at Jalpaiguri district which is characterized by dense population of *Microstegium chiliatum*, *Shorea robusta*, *Terminalia tomentosa*, *Schima wallichii*, etc.

15. Champion, H.G., and Seth, S.K. 1968. A Revised Forest Types of India. Manager of Publications, Government of India, Delhi.
16. Research Circle, Directorate of Forests, GoWB. 2010. State Report on National Programme on Promoting Medicinal Plants Conservation, and Traditional Knowledge for Enhancing Health and Livelihood Security for West Bengal. UNDP-CCF-II-Project No 13047.

c. Eastern Tarai Sal Forest generally found in lower altitudes compared to other two types of forest. This type of forest is characterized by various species of Bamboos , Ferns , *Shorea robusta,* which is found in Baikunthapur Forest.

Apart from the naturally vegetated areas, there are a series of plantations at North Sevoke Block comprising over 2.7 sq km area. The species grown are mainly *Tectona grandis* and *Shorea robusta*. The other species grown are *Michelia champaca*, *Lagerstroemia speciosa*, *Salmalia malabarica*, *Dalbergia sissoo*, *Gmelina arborea*, *Terminalia crenulata*, *Schima wallichii*, *Terminalia myriocarpa* and *Chukrasia tabularis*.

The forests in and around Siliguri are recorded as two storeyed forest. In the upper storey, *Shorea robusta* is sporadic, in association with *Carya arborea*, *Terminalia crenulata*, *Tetrameles nudiflora*, *Sterculia villosa*, *Gmelina arborea*, *Acrocarpus fraxinifolius*, *Lagerstroemia parviflora*, *Duabanga sonneratoides*, *Chukrasia tabularis* and *Albizzia spp*. The lower storey is composed of *Bauhinia purpurea*, *Phoebe lanceolata*, *Macaranga spp*., *Oroxylum indicum*, *Pterospermum acerifolia*, *Fagara budrunga*, *Alstonia scholaris*, *Cinnamomum tamala* and *Bacaurea sapida*. The under growth is formed mainly by *Thysanolaena maxima*, *Argeratum spp*., *Clerodendron viscosum*, *Eupatorium odoratum*, *Leea spp*. and *Dendrocalamus hamiltonii* (sometime in pure patches). The climbers generally found are *Mimosa himalyana*, *Bauhinia vahlii*, *Tinospora cordifolia*, *Mikania*[17].

Choudhari et al. (2014)[18] conducted a taxonomic reconnaissance for Himachal Vihar Complex, which is situated on the outskirts of Siliguri city and identified 241 vascular plants during the exercise. This is the only known study of urban biodiversity from the city.

A short distance from the city is present the North Bengal Wild Animals Park also known as Bengal Safari. The flora found within the park is similar to the flora seen within the city and can be used as a proxy for the city's flora[19].

The area in the immediate vicinity of Siliguri is an extremely important habitat of the wild elephants (*Elephas maximus*) which is the principal species of the area. The other associated species of the area are gaur (*Bos gaurus*), tiger (*Panthera tigris*), barking deer (*Muntiacus muntjak*), wild pigs (*Sus scrofa*), monkey, civets, snakes, lizards, sambar (*Rusa unicolor*), chital (*Axis axis*) and fishing cat (*Prionailurus viverrinus*). These forests are also home of about 243 different bird species like pied hornbill (*Anthracoceros albirostris*), egrets, kingfisher, drongo, fly catcher, woodpeckers and others. Another common sight is migratory water birds.

Paul *et al.* (2009)[20] recorded 71 species of fish in freshwater sites around Siliguri between 2005 and 2007. Of the five sites surveyed, data from two sites i.e. River Mahananda near Siliguri and River Balason near Matigarah were considered to host likely species which could be found within the riverine areas of Siliguri city. A total of 50 species were found within these two sites. This list was also validated by Dr. Bimal Chanda, a specialist in Ichthyofauna who is based in Siliguri.

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17. Research Circle, Directorate of Forests, GoWB. 2010. State Report on National Programme on Promoting Medicinal Plants Conservation, and Traditional Knowledge for Enhancing Health and Livelihood Security for West Bengal. UNDP-CCF-II-Project No 13047
18. Choudhuri, A., Majumdar. S, and Bhattacharya, A. 2014. A Taxonomic Reconnaissance in Himachal Vihar Complex, Matigara, Siliguri, West Bengal. 29. 99-112.
19. West Bengal Zoo Authority.2016. Master Plan of North Bengal Wild Animals Park, Siliguri. 2016-17 to 2026-37. Government of West Bengal, Kolkata
20. Paul, M., Gupta, S. and Banerjee, S. 2009. Fish Fauna of Major Rivers of Darjeeling District, with Special Reference to their Conservation Status. Rec. zool. Surv. India: 109(Part-4) : 15-23.

Pal (2017)[21] recorded 69 species of odonates belonging to 41 genera and nine families found within the University of North Bengal Campus which is a mere 4-5 kms away from Siliguri city.

De (2016)[22] published a list of amphibians recorded from the district of Darjeeling, West Bengal describing 37 species of amphibians under 18 genera and 8 families.

Administration of Biodiversity

Krishnan *et al*. (2012) detail out five types of biodiversity governance models that aid in conservation, sustainable use, and fair and equitable sharing of biological resources across different landscapes in India. Of the five models, two – territorial forests and protected areas– fall under the protected area type of biodiversity governance models. The other three – autonomous community efforts, co-management of forests and decentralized governance of biodiversity – are considered more closely under community based conservation.

In Siliguri the following institutions at the state and the city level, are responsible for biodiversity.

Biodiversity Management Committee (BMC): Under the Biological Diversity Act, 2002, every local body has to constitute a BMC for the purpose of promoting conservation, sustainable use and documentation of biological diversity. An important function of the BMC is the preparation of a People's Biodiversity Register (PBR) that contains comprehensive information on availability and use of local biological resources, or any other traditional knowledge associated with them. The BMC, is supposed to serve as the guardian of all biological resources and traditional knowledge. Siliguri's BMC was formed in September 2019. However, the committee has yet to start functioning in full swing. The members of the BMC are listed below,

- Hon'ble Mayor, SMC
- Sri. Ram Bhajan Mahato, Deputy Mayor, SMC
- Munshi Nurul Islam, MMIC, SMC
- Sri. Mukul Sengupta, MMIC, SMC
- Dr. Sankar Ghosh, MMIC, SMC
- Ms. Pritikana Biswas, Councillor, SMC
- Commissioner, SMC
- Secretary, SMC
- Superintending Engineer, SMC (Convenor)
- Executive Engineer, SMC
- Sri. Linton Chandra Bhowmik, Advisor, SMC
- Assistant Engineer (Electrical), SMC
- Assistant Engineer (Civil), SMC
- Dr. Prabir Panda, Social Worker
- In-charge, Conservancy section, SMC
- In-charge, Environment section, SMC

Siliguri Municipal Corporation (SMC): The civic governing body is the Siliguri Municipal Corporation. There are 47 wards in the SMC which are clustered in five boroughs, wherein, each borough comprises of around eight to ten contiguous wards. The role of SMC in offering the basic services delivery overlaps with other state level government bodies, while financing of the same is dependent on the state and

21. Pal, A. 2017. Dragonflies and damselflies of University of North Bengal campus, West Bengal, India with new distribution record of Agriocnemis kalinga Nair & Subramanian, 2014. Journal of Threatened Taxa 9(12): 11067â11073; http://doi.org/10.11609/jott.3785.9.12.11067-11073. Accessed on 5 May, 2020.
22. De, K. 2016. Checklist of Amphibian Fauna of Darjeeling District, West Bengal. Journal of Entomology and Zoology Studies; 4(3): 387-390

National Governments. When it comes to biodiversity related activities, SMC along with other state level government bodies are responsible as given in Table 7. For more information please visit http://www.siligurismc.in/

Siliguri Jalpaiguri Development Authority (SDJA): Established in 1979, the SJDA is entrusted with the responsibility of Planning and Development of Siliguri - Jalpaiguri Planning Area. Some of the responsibilities include the preparation of a land use map, an outline development plan, and to plan and execute various development schemes. The Authority also co-ordinates various development activities of local and state departments and agencies which operate within the Planning Area. For more information please visit https://www.sjda.org/SJDA/#

North Bengal Development Department (NBDD): The NBDD promotes the social, economic and cultural advancement of people residing in the six districts of North Bengal viz. Darjeeling, Jalpaiguri, Cooch Behar, Uttar Dinajpur, Dakshin Dinajpur and Malda. It coordinates all matters related with infrastructural facilities through improvement of rural communication, water resources, and preservation of ecological balance, socio-economic and allied development programmes, research, training and technology in the areas covered by the Uttar Banga Unnayan Parshad. For more information please visit http://wbnorthbengaldev.gov.in/htmlpage/index.aspx

Table 7: Responsibility chart of biodiversity related activities in Siliguri

Service	Siliguri Municipal Corporation	Other Government Departments
Biodiversity Conservation	Environment Department	❍ SJDA, GoWB ❍ North Bengal Development Department (NBDD), GoWB ❍ Office of the Sub Divisional Officer http://www.siliguri.gov.in/
Green and Open Spaces	Department of Trade License, Parks & Gardens, Law & Guest Houses	❍ SJDA, GoWB ❍ North Bengal Development Department (NBDD), GoWB

Part B: Indicators of the Singapore Index on Cities' Biodiversity

Native Biodiversity

Indicator 1: Proportion of Natural Areas in the City

Methodology

As per the CBI user manual

Principle for calculation of the indicator
(Total area of natural, restored and naturalised areas) ÷ (Total area of city) × 100%

Scoring Range: (based on the CBI user manual)
0 point: <1.0%
1 point: 1.0% - 6.9%
2 points: 7.0% - 13.9%
3 points: 14.0% - 20.0%
4 points: > 20.0%

City Data
The natural areas as defined within the Singapore Index Manual are "Natural areas comprise predominantly native species and natural ecosystems, which are not, or no longer, or only slightly influenced by human actions, except where such actions are intended to conserve, enhance or restore native biodiversity." This definition of natural areas has been followed as closely as possible when it comes to selection of natural areas. However, it was not possible to only consider areas which are free from most human activities. Income inequality, a high population density, and limited infrastructural outreach means that while there are native and natural ecosystems occurring within a city, public access to these areas cannot be completely restricted.

To calculate the proportion of natural areas in the city, a natural asset map (Figure 7) which was developed under the CapaCITIES project which is being implemented in Siliguri, West Bengal in cooperation with the Siliguri Municipal Corporation, supported by SDC, was referred to. Table 5 shows the various classes of natural assets identified within the map. Several of these categories do not fit into the definition of natural areas laid out in the Singapore Index such as open green spaces, open groundand tree patches. The main areas that fall under natural areas are- river, ponds, riverine vegetation, and sparse vegetation (Table 8).

Table 8: Natural Asset Classes used in the calculation of Indicator 1

Sl. No.	Land Class	Area in sq. m.
1	River	4.38
2	Ponds	0.01
3	River bank / Riverine vegetation	0.86
4	Sparse vegetation	1.45

Indicator 1 = (Total area of natural, restored and naturalised areas) ÷ (Total area of city) × 100%

Total area of natural, restored and naturalised areas = 6.706 sq. km. (calculations include the total area of the river and other water bodies within the city limits)

Total area of the city = 41.9 sq. km.

RESULT: 16%

SCORE: 3

Recommendations to Improve Score

Siliguri city can improve their score under this indicator by developing a city level LBSAP which will help to protect, improve and monitor these natural areas. A large contribution to the score of this indicator comes from the river and its associated ecosystem. This ecosystem should be recognised within the LBSAP and protection as well as restoration activities prioritised for it.

Indicator 2: Connectivity Measures or Ecological Networks to Counter Fragmentation

Methodology

As per the CBI user manual

Principle for calculation of the indicator

$$\frac{1}{A_{total}} * \left(A_1^2 + A_2^2 + A_3^2 + \ldots + A_n^2\right)$$

Where:

- A_{total} is the total area of all natural areas
- A_1 to A_n are areas that are distinct from each other (i.e. more than or equal to 100m apart)
- $_n$ is the total number of connected natural areas

This measures effective mesh size of the natural areas in the city. A1 to An may consist of areas that are the sum of two or more smaller patches which are connected. In general, patches are considered as connected if they are less than 100m apart.

Scoring Range: (based on the CBI user manual)

0 point:	< 200 ha
1 point:	201 - 500 ha
2 points:	501 - 1000 ha
3 points:	1001 - 1500 ha
4 points:	> 1500 ha

City Data

The patches associated with the land classes used to calculate indicator 1 i.e. river, ponds, riverine vegetation, and sparse vegetation, have been considered in this calculation. There are 220 different natural asset class polygons inside the SMC boundary. As per the 100 m proximity rule these 220 polygons can be merged into 56 patches A_1 - A_{56}. The patch sizes are detailed in Annexure 1.

A_{total} = 377.38 ha

As per the final calculation

Indicator 2 = 1/377.38 ha X (97335.91 ha ^{2}) = 257.93 ha

RESULT: 257.93 ha

SCORE: 1

Recommendations to Improve Score

The city can work towards the improvement of this score by supporting restoration around natural areas and providing them with some form of protection. Local NGOs can help in securing community support for the same. A cohesive vision for the same can come through the LBSAP.

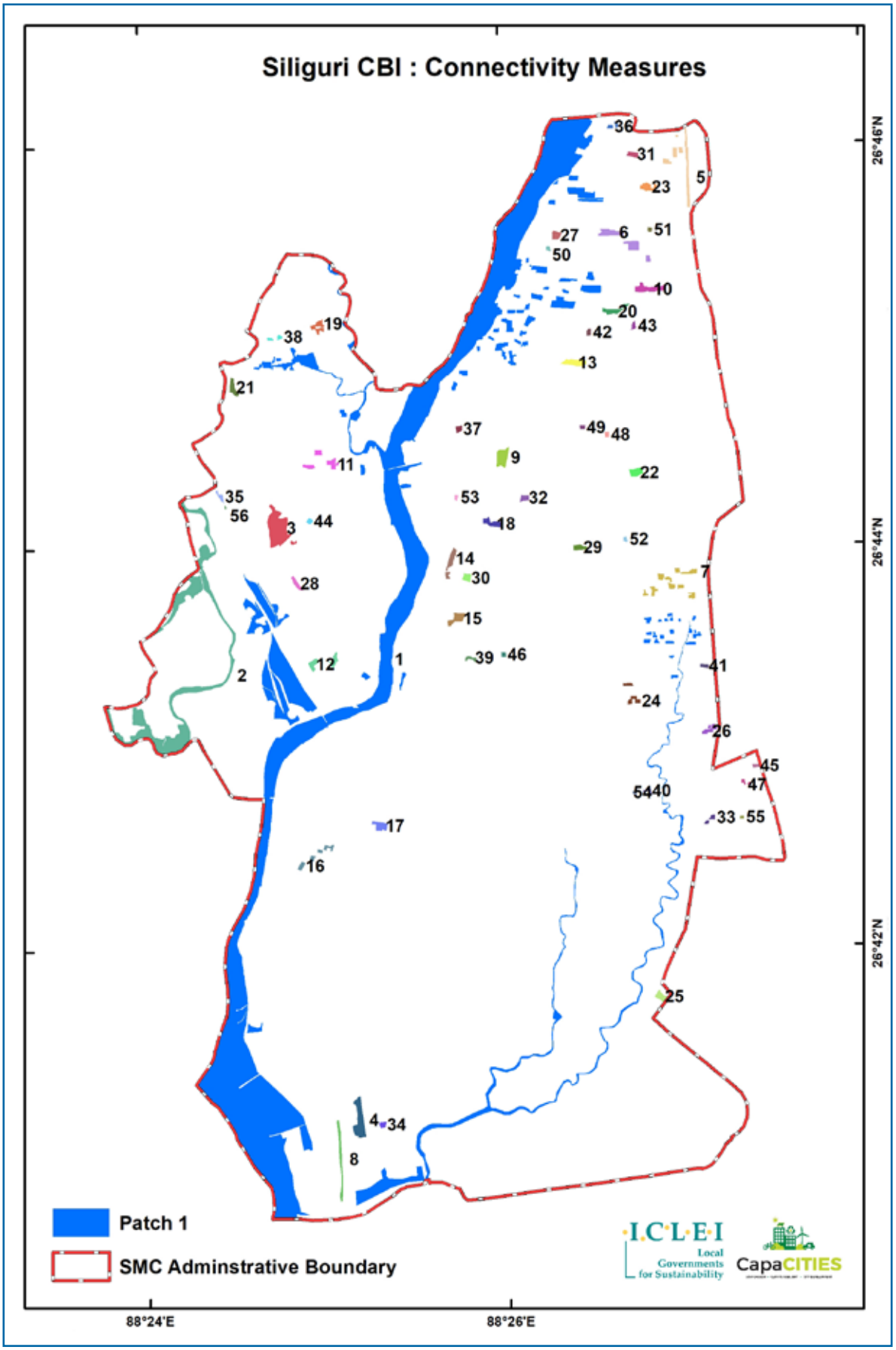


Figure 8: Natural patches within the jurisdiction of Siliguri Municipal Corporation

Indicator 3: Native Biodiversity in Built up Areas (Bird Species)

Methodology

How to calculate indicator

Number of native bird species in built up areas where built up areas include impermeable surfaces like buildings, roads, drainage channels, etc., and anthropogenic green spaces like roof gardens, roadside planting, golf courses, private gardens, cemeteries, lawns, urban parks, etc. Areas that are counted as natural areas in indicator 1 should not be included in this indicator.

Scoring Range: (based on the CBI user manual)

0 point: < 19 bird species
1 point: 19 - 27 bird species
2 points: 28 - 46 bird species
3 points: 47 - 68 bird species
4 points: > 68 bird species

City Data

A detailed and comprehensive inventory of bird diversity in Siliguri city is absent and neither is there any data from citizen science platforms like eBird, developed by Cornell Lab of Ornithology. While there is substantial work done on natural areas around by the municipal corporation, there is a distinct gap with regards to any kind of documentation of birds within the city. The forests around Siliguri city host 243 species of birds. According to an article in a mainstream newspaper around 60 species of migratory birds visit the environs of Siliguri[23].

For the purpose of calculating Indicator 3, data was extrapolated from eBird for nearby sites such as Sukhna forest (13 km away from Siliguri). This list was refined by consulting birding experts (Annexure 2). The list was then categorized into residents and migrants. Species which frequent the city's riverine ecosystem were excluded as per the instructions of the CBI. Furthermore, the list was also checked for common urban birds by birding experts. The checklist is given in Annexure 2.

The total number of species which were identified in this method is 151 out of which 77 are urban residents.

RESULT: 77 Species

SCORE: 4

Recommendations to Maintain Score

In order to sustain this score, the city needs to ensure the maintenance of its natural spaces and mosaic of habitats, which provide resources for birds of the city.

23. https://www.business-standard.com/article/news-ani/siliguri-becomes-new-haven-of-migratory-birds-117010700076_1.html. Accessed on 3 April, 2020

Indicators 4 - 8: Change in Number of Native Species

Methodology

How to calculate indicator

The change in number of native species is used for indicators 4 to 8. The three core groups are:

- Indicator 4 : vascular plants
- Indicator 5 : birds
- Indicator 6 : butterflies

These groups have been selected as data are most easily available and to enable some common comparison.

Cities can select any two other taxonomic groups for indicators 7 and 8 (e.g. bryophytes, fungi, amphibians, reptiles, freshwater fish, molluscs, dragonflies, beetles, spiders, hard corals, marine fish, seagrasses, sponges, etc.)

The above data from the first application of the Singapore Index would be recorded in Part I: Profile of the City as the baseline.

Net change in species from the previous survey to the most recent survey is calculated as:

Total increase in number of species (as a result of re-introduction, rediscovery, new species found, etc.) minus number of species that have gone extinct.

Scoring Range: (based on the CBI user manual)

0 point:	Maintaining or a decrease in the number of species
1 point:	1 species increase
2 points:	2 species increase
3 points:	3 species increase
4 points:	4 species or more increase

City Data

The city lacks a comprehensive documentation of the local biodiversity although a lot of work has been done in nearby protected areas which lie outside the jurisdiction of the city corporation. For the indicators 4-8, data from publications like Choudhari et al. (2014)[19], Paul et al. (2005)[20], Pal et al. (2017)[22], De (2016)[23], citizen science platforms like eBird and inaturalist were considered. Annexure 2 provides details of the species lists that have been considered for indicators 4-8.

For indicators 6, 7 and 8, the taxonomic groups of Freshwater Fish, Odonates and Amphibians, respectively were chosen. These lists will form the baseline for comparison when the index is revisited by the city, after 5 years. These lists have been extrapolated from the secondary data sources mentioned above and are not based on any primary field surveys conducted. Some of the data are district level data. The species lists can be found in Annexure 2.

RESULT: Since this is the baseline year for the species count, the city will not receive any score on the indicators 4-8 and it will be excluded from the overall calculation.

Indicator 9: Proportion of Protected Natural Areas

Methodology

How to calculate indicator
(Area of protected or secured natural areas) ÷ (Total area of the city) × 100%

Scoring Range: (based on the CBI user manual)
0 point: < 1.4%
1 point: 1.4% - 7.3%
2 points: 7.4% - 11.1%
3 points: 11.2% - 19.4%
4 points: > 19.4%

City Data
As detailed in Part 1 of the index, the governance models for biodiversity in India are of 5 types, which fall under two main streams- State driven conservation and Community based conservation. Within Siliguri city however, there is no natural area which receives protection although there are wildlife sanctuaries 10 km away from the city limits.

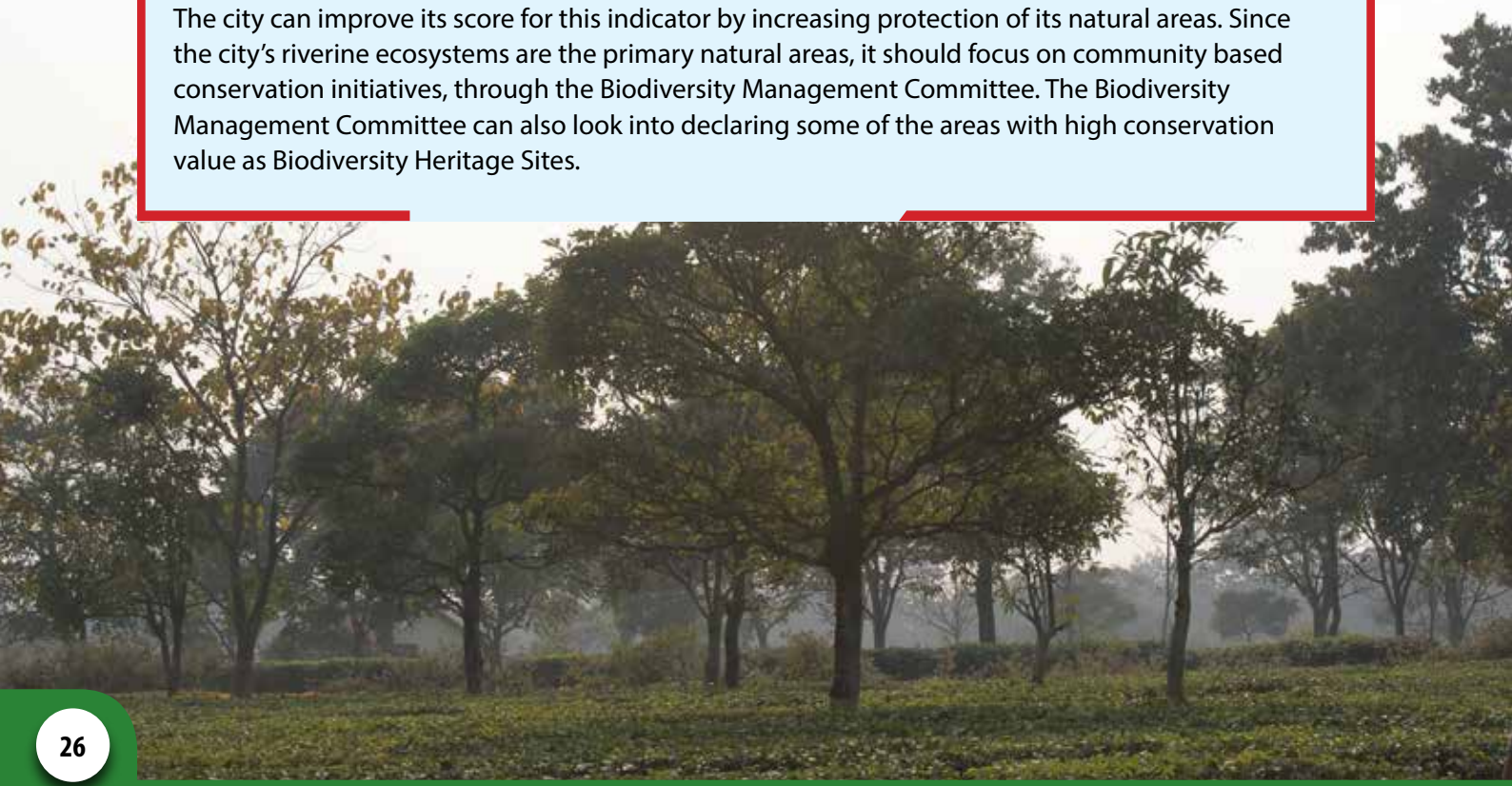
Indicator 9 = (Area of protected or secured natural areas) ÷ (Total area of the city) × 100%

RESULT: 0%

SCORE: 0

Recommendations to Improve Score

The city can improve its score for this indicator by increasing protection of its natural areas. Since the city's riverine ecosystems are the primary natural areas, it should focus on community based conservation initiatives, through the Biodiversity Management Committee. The Biodiversity Management Committee can also look into declaring some of the areas with high conservation value as Biodiversity Heritage Sites.



Indicator 10: Proportion of Invasive Alien Species

Methodology

How to calculate indicator
(Number of invasive alien species) ÷ (Number of native species) × 100%

Scoring Range: (based on the CBI user manual)
0 point: > 30.0%
1 point: 20.1% - 30.0%
2 points: 11.1% - 20.0%
3 points: 1.0% - 11.0%
4 points: < 1.0%

City Data
In India, the most well documented taxa in terms of alien species are terrestrial plants. The definition which has been considered for this indicator in the CBI is "one whose introduction and/or spread threatens biological diversity (For the purpose of the present guiding principles, the term "invasive alien species" shall be deemed the same as "alien invasive species" in accordance with Decision V/8 of the CoP to the Convention on Biological Diversity)".

The flowering plant taxon was selected for the purpose of calculation of indicator 10. A comprehensive floral profile for the city is missing however there has been one study (Choudhuri et al., 2014)[18], in Himachal Vihar, Matigara, Siliguri which has documented flora of the area and which was considered. Further, an inventory of the flora of the North Bengal Wild Animals Park (West Bengal Zoo Authority, 2016)[19] has also been considered as the park is situated close to the city and hosts a similar floral profile. The species details can be found in Annexure 2. The species identified in these two resources were then classified into native and introduced species, using online sources. Exotic species were further refined into alien invasive species using the critieria in Sekhar *et al*. (2012)[24] and Moktan and Das, (2013)[25] which is provided in Tables 14-18 in Annexure 2.

Out of 442 flowering plants in Siliguri, 311 are native and 131 are introduced. Of the 131 which are introduced, 49 are alien invasives. Number of invasive alien species = 49 ÷ Number of native species = 311 x 100%.

RESULT: 15.75%

SCORE: 2

Recommendations to Improve Score

It is important that a detailed study of the city's flora be conducted. Once this is done, the species inventoried can be assessed based on their invasiveness and a risk assessment of the invasive ones be conducted. The risk assessment will enable an understanding of which invasive species are high, medium, low and insignificant in their impacts on local ecosystems. Species specific distribution maps of the invasive plants should be developed with support from the Botany Department of North Bengal University. This information will help to control and monitor the spread of the invasive species.

24. Sekar, K. C., Manikandan, R., and Srivastava, S. K. 2012. Invasive alien plants of Uttarakhand Himalaya. *Proceedings of the National Academy of Sciences*, India Section B: Biological Sciences, 82(3): 375-383.
25. Moktan, S., and Das, A. P. 2013. Diversity and distribution of invasive alien plants along the altitudinal gradient in Darjiling Himalaya, India. Pleione 7(2): 305 - 313

Indicator 11: Regulation of Quantity of Water

Methodology

How to calculate indicator
(Total permeable area) ÷ (Total terrestrial area of the city) × 100%

Scoring Range: (based on the CBI user manual)
0 point: < 33.1%
1 point: 33.1% - 39.7%
2 points: 39.8% - 64.2%
3 points: 64.3% - 75.0%
4 points: > 75.0%

City Data

Since, no published data is available on impermeable/permeable surfaces of Siliguri, a land use land cover map which was developed by ICLEI South Asia under the CapaCITIES project (Figure 9), was used to calculate the proportion of all permeable areas. The land classes considered in the calculation are Railway, Urban built-up: residential, Urban built-up: mixed, Urban slum, Railway residence, Tree patches, Open spaces, River / Water body and Sparse vegetation (Table 9). Some of the land classes like Railway, urban built-up residential, urban built-up mixed, urban slum, and railway residence are not 100% permeable. Therefore for the purpose of calculation of the indicator, based on some amount of ground truthing that was carried out, only a certain proportion of these areas were considered as given in Table 10.

Table 9: Area wise distribution of land class category (inside SMC boundary)

Sl. No	Land Class	Area (ha)
1	Road network	290.16
2	Railway land*	210.57
3	Urban built-up: commercial / industrial	477.72
4	Urban built-up: residential	1448.83
5	Urban built-up: mixed	249.68
6	Urban slum	342.56
7	Railway residence	82.02
8	Tree patches	204.57
9	Open spaces	379.02
10	River / Water body	526.94
11	Sparse vegetation	145.17
12	Stadium	3.14
13	Dumpsite	9.36

* Land under the ownership of railway, includes railway tracks, station and railway land with sparse vegetation

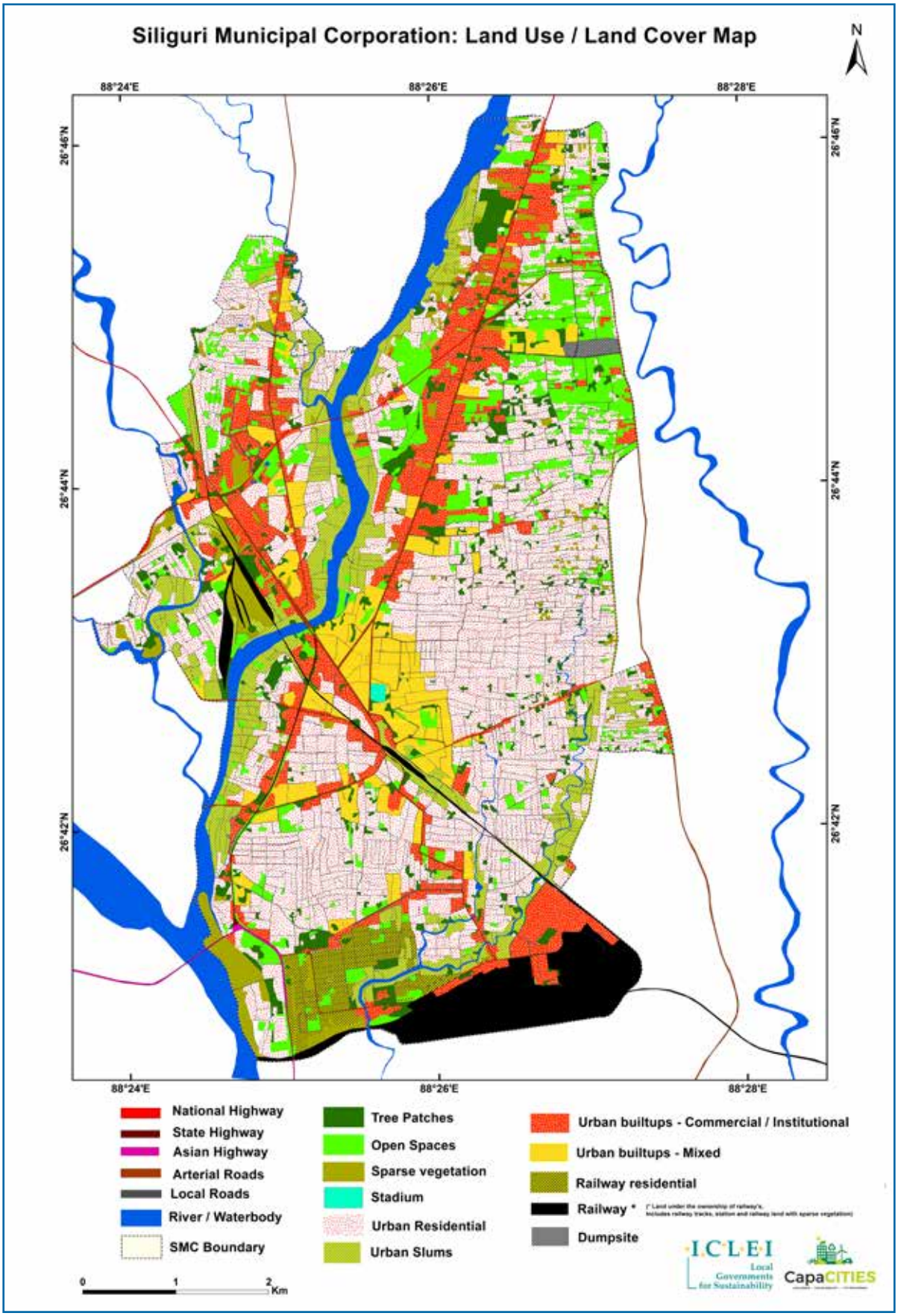


Figure 9: Land Use Land Cover Map

Table 10: Land classes used in the calculation of Indicator 9

Sl. No	Land Class	Area (sq.km)
1	60% Railway land*	1.26
2	30% Urban built-up: residential	4.35
3	5% Urban built-up: mixed	0.13
4	10% Urban slum	0.34
5	60% Railway residence	0.49
6	Tree patches	2,05
7	Open spaces	3.79
8	River / Water body	5.27
9	Sparse vegetation	1.45

* Land under the ownership of railway, includes railway tracks, station and railway land with sparse vegetation

Total permeable area = area of 60% Railway land + 30% urban built-up residential + 5% urban built-up mixed + 10% urban slum + 60% railway residence + tree patches + river/water body + open spaces + sparse vegetation = 19.13 sq km.

Total terrestrial area = 36.63 sq. km.

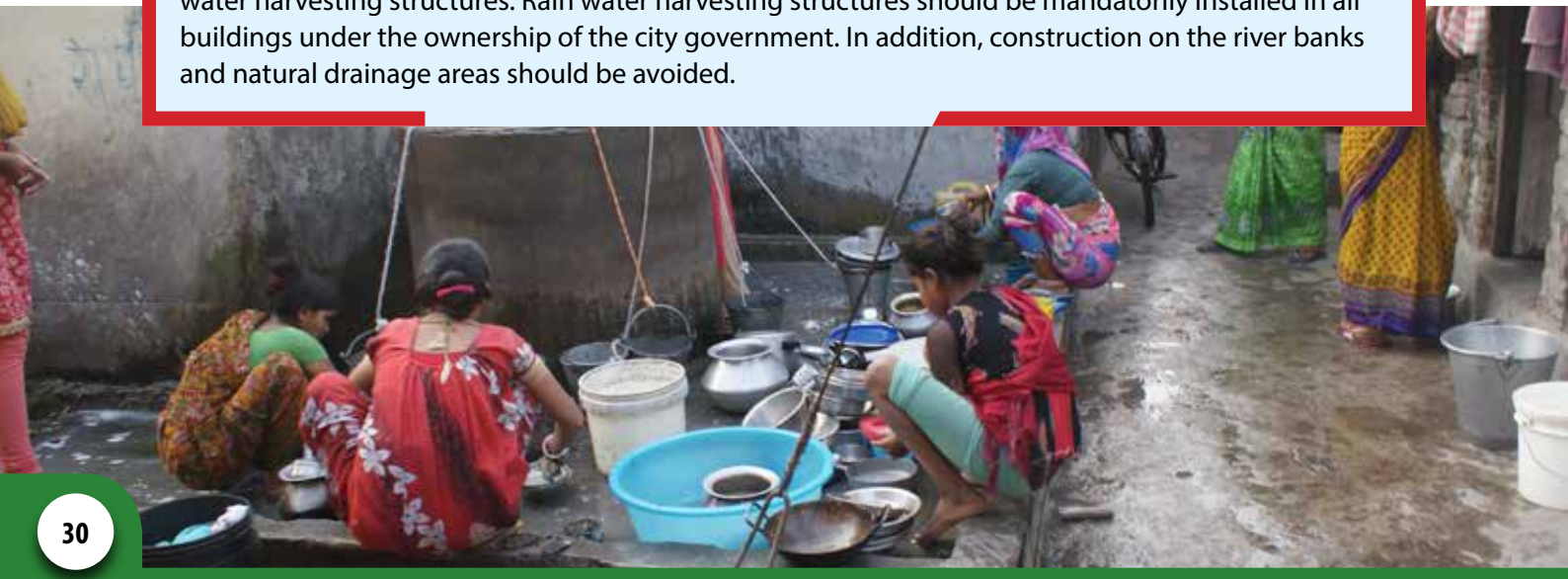
Proportion of permeable area = 52.22% which scores 2 points.

RESULT: 52.22%

SCORE: 2

Recommendations to Improve Score

The city should look into Nature-based Solutions to improve the percolation of rainwater into the ground. Encouraging citizens to install rainwater harvesting structures can also improve capture of rainwater and reduce run-off. Increasing the proportion of vegetated (trees, shrubs, herbs) surface areas in the city through greening will also support the regulation of water. Support of local NGOs in generating awareness on these aspects can be taken. The city government can also look at some proportion of exemption in house tax for houses which have installed and are maintaining rain water harvesting structures. Rain water harvesting structures should be mandatorily installed in all buildings under the ownership of the city government. In addition, construction on the river banks and natural drainage areas should be avoided.



Indicator 12: Climate Regulation: Carbon Storage and Cooling Effect of Vegetation

Methodology

How to calculate indicator
(Tree canopy cover) ÷ (Total terrestrial area of the city) × 100%

Scoring Range: (based on the CBI user manual)
0 point: < 10.5%
1 point: 10.5% - 19.1%
2 points: 19.2% - 29.0%
3 points: 29.1% - 59.7%
4 points: > 59.7%

City Data
Indicator 12 measures the tree cover within the city and is used as a proxy for larger functions of climate regulation and carbon storage.

This indicator is calculated based on the land use land cover map (Figure 9), taking into account the land use classes Railway land, Urban built-up residential urban slum, railway residence, tree patches, open spaces and dumpsite. Each of these land classes comprise some percent of trees, as given in Table 11. Ground truthing exercises were carried out to arrive at approximations for the percent of tree cover found within the various land classes.

Table 11: Land classes used in the calculation of Indicator 12

Sl. No	Land Class with % Tree Cover	Area (sq.km)
1	Railway land* (20%)	0.42
2	Urban built-up: residential (5-10%)	1.45
3	Urban slum (5-10%)	0.34
4	Railway residence (20%)	0.16
5	Tree patches (100%)	2.05
6	Open spaces (15-20%)	0.76
7	Dumpsite (10%)	0.009

* Land under the ownership of railway's Includes railway tracks, station and railway land with sparse vegetation

Therefore the total tree cover in the city of Siliguri is 5.19 sq km

The total terrestrial area of the city is 36.63 sq km.

(Tree canopy cover) ÷ (Total terrestrial area of the city) × 100%

(5.19) ÷ (36.63) × 100% = 14.17% which is between 10.5 and 19.1 % and therefore scores 1 point.

RESULT: 14.17%

SCORE: 1

Recommendations to Improve Score

The city can improve their score for this indicator through a mix of activities related to conservation and restoration of its green spaces. Plantation of native tree species should be actively taken up by SMC. Though a lot of plantations are carried out, emphasis needs to be given on the survival and monitoring of the plantations. The BMC, with support from local NGOs can play a significant role in the same.

Indicator 13: Recreational Services

Methodology

How to calculate indicator
(Area of parks with natural areas and protected or secured natural areas)/1000 persons

Scoring Range: (based on the CBI user manual)
0 point: < 0.1 ha/1000 persons
1 point: 0.1 - 0.3 ha/1000 persons
2 points: 0.4 - 0.6 ha/1000 persons
3 points: 0.7 - 0.9 ha/1000 persons
4 points: > 0.9 ha/1000 persons

City Data

According to the CDP[12] of Siliguri, the total area used recreational land use is 1.68 sq km. This covers the area under 39 parks and 5 recreational areas (clubs, cinemas and playgrounds) which are distributed around the city.

The area occupied by the 39 parks is 0.077 sq km. (Table 12).

Table 12: List of parks and playgrounds maintained by SMC

Sl. No.	Park and Play Ground	Area (sq. m.)
1	Children Park at Diseal Colony	225.00
2	Children Park at Bagha Jatin Colony	305.00
3	Adarsha Nagar Park at Adarsha Nagar	325.00
4	Children Park at Ganga Nagar	296.00
5	Sampriti Park at Mahananda Para	296.00
6	Surya Sen Park at Mahananda Para	28,112.45
7	Children Park at Ashrarmpara	269.00
8	Sishu Uddyan at College Para	4,859.44
9	Children Park at Ward No.17	269.08
10	Bagha Jatin Park at Ward No.17	4,859.44
11	Chotodar Asar at Ward No. 19	923.69
12	Azad Hind Park at Subhas Pally	428.00
13	Swami Chaitananda Sishu Uddyan at Ward No. 21	169.48
14	Pratik Sishu Uddayan at Ward No. 22	570.28
15	Park at Ward No. 22	673.90
16	Nabin Sangha Park at Ward No. 22	248.00
17	Siliguri Park at Ward No. 23	6,176.71
18	Milan Pally Park at Milian Pally	305.22
19	Babu Para Boys Club Park at Babu Para	348.00
20	Boot House Park at Desbandhu Para	364.00

Sl. No.	Park and Play Ground	Area (sq. m.)
21	Swami Vivekananda Park at Ward No. 27	298.00
22	Tikia Para Park at Ward No. 28	348.00
23	Subrata Sishu Uddyan at Ward No 30	248.00
24	Balararn Saha Smrity Sishu Uddyan at Shaktigarh	789.16
25	Park at Nouka Ghat at Nouka Ghat	19,518.07
26	Park at Sreepally	839.36
27	Saktigarh Park at Shaktigarh	745.00
28	Park at Surya Sen Colony at Ward No. 34	425.00
29	Sahid Colony Park at Sahid Colony	368.00
30	Dakhin Shanti Nagar Park at Shanti Nagar	323.00
31	Park at Amtala Colony	144.58
32	Park at Amtala, Shastrinagar	1,096.39
33	Park at Shastrinagar	184.74
34	Park at Sahid Nagar at Sahind Nagar	348.00
35	Gandhi Nagar Park at Ward No. 43	305.22
36	Bagha Jatin Colony Park at Bagha Jatin Colony	424.00
37	Green Park at Ward No. 46	386.00
38	Ramkrishna Nagar Park at Ward No. 47	357.43
39	New Colony Park at Ward No 47	228.92

The area around the river is also used for recreation and as per the natural asset map (Figure 7, Table 5) this comes to 5.24 sq km (Area of the river and river bank + Riverine vegetation)

The total area used within the city for recreational purposes is therefore: 7.7 ha + 524 ha = 531.7 ha / 1000 persons = 0.53 ha.

RESULT: 0.53 ha

SCORE: 2

Recommendations to Improve Score

To improve this score, the city needs to set aside more green space for public access and recreation. The city can look into corridor or linear parks. Resident Welfare Associations and support from the private sector through Corporate Social Responsibility can be taken for maintenance of these parks.

Indicator 14: Educational Services

Methodology

How to calculate indicator
Average number of formal educational visits per child below 16 years to parks with natural areas or protected or secured natural areas per year

Scoring Range: (based on the CBI user manual)
0 point: 0 formal educational visit/year
1 point: 1 formal educational visit/year
2 points: 2 formal educational visits/year
3 points: 3 formal educational visits/year
4 points: > 3 formal educational visits/year

City Data
Visits, if any, to parks are at the discretion of the school and are not mandated within the curriculum by educational boards.

Therefore for this indicator, the city will score zero.

RESULT: No formal educational visit

SCORE: 0

Recommendations to Improve Score

Siliguri city administration does not have an influence on the curriculum of the various boards followed by schools in the city. However, the city administration can give a directive to all schools to include such visits in their curriculum.

The various school boards responsible for curriculum development should consider including mandatory practical aspects and educational visits to support theoretical frameworks within themes of biodiversity education in curricula. The city administration should send a request in this regard to all the school boards, through the state government.

Indicator 15: Budget Allocated to Biodiversity

Methodology

How to calculate indicator
(Amount spent on biodiversity related administration) ÷ (Total budget of city) × 100%

Scoring Range: (based on the CBI user manual)
0 point: < 0.4%
1 point: 0.4% - 2.2%
2 points: 2.3% - 2.7%
3 points: 2.8% - 3.7%
4 points: > 3.7%

City Data
Most budgetary allocations made towards biodiversity have been towards the upkeep and maintenance of parks in the city of Siliguri.

Amount spent on biodiversity related administration = 20.2 million INR (Budget 2019-20)

Total Budget = 4.3 billion INR (Budget 2019-20)

RESULT: 0.47%

SCORE: 1

Recommendations to Improve Score

The city should take up a more active role in biodiversity governance, by developing its LBSAP and incorporating interventions from the same into the annual municipal budget. This will on one hand help to improve this score, and the other hand it will help to improve the overall quality of life in the city.

Indicator 16: Number of Biodiversity Projects Implemented by the City Annually

Methodology

How to calculate indicator
Number of programmes and projects that are being implemented by the city authorities, possibly in partnership with private sector, NGOs, etc. per year.

In addition to submitting the total number of projects and programmes carried out, cities are encouraged to provide a listing of the projects and to categorise the list into projects that are:
1. Biodiversity related
2. Ecosystems services related

Scoring Range: (based on the CBI user manual)
0 point: < 12 programmes/projects
1 point: 12 - 21 programmes/projects
2 points: 22 - 39 programmes/projects
3 points: 40 - 71 programmes/projects
4 points: > 71 programmes/projects

City Data
This indicator is calculated based on the number of biodiversity related projects and programmes that the city authorities are involved in, either as the main player or in partnership with NGOs and the private sector, where the city is a key collaborator.

The city has implemented the following projects for the year 2019-20
1. Green Cities Mission
2. Greening activities and plantations through Member of Parliament Local Area Development Fund/ Member of Legislative Assembly Local Area Development Fund
3. CapaCITIES (Supported by Swiss Agency for Development and Cooperation)
4. Plantation drives in partnership with 39 NGOs
5. Social Forestry programmes with i Social Forestry Division of the State Forest Department

RESULT: < 12

SCORE: 0

Recommendations to Improve Score

The city needs to look into implementing more biodiversity related projects and programmes. Since the city's primary natural ecosystem is its riverine system, it can identify funding streams and partnerships that will enhance the ecological function of this area.

The city should develop its LBSAP and can take up activities identified therein, through partnerships with state agencies, local NGOs, academic institutions and the private sector.

Indicator 17: Policies, Rules and Regulations – Existence of Local Biodiversity Strategy and Action Plan

Methodology

How to calculate indicator
Status of LBSAP (or any equivalent plan); number of associated CBD initiatives.

Scoring Range: (based on the CBI user manual)

0 point:	No LBSAP*
1 point:	LBSAP not aligned with NBSAP
2 points:	LBSAP incorporates elements of NBSAP, but does not include any CBD initiatives**
3 points:	LBSAP incorporates elements of NBSAP, and includes one to three CBD initiatives
4 points:	LBSAP incorporates elements of NBSAP, and includes four or more CBD initiatives

* LBSAP or equivalent.
** The thematic programmes of work and cross-cutting issues of the CBD are listed in http://www.cbd.int/programmes/. The Strategic Plan for Biodiversity (2011-2020), including the Aichi Biodiversity Targets can also be used as a reference framework (http://www.cbd.int/sp/default.shtml).

City Data
The city has started developing the LBSAP. However the same is not final yet. The score for this indicator is therefore 0 points.

RESULT: LBSAP being prepared

SCORE: 0

Recommendations to Improve Score

Several scores within this index for Siliguri city can be improved with the development of an LBSAP, which will help the city better plan and administer to the local biodiversity. The LBSAP once developed should be taken up actively by the city corporation for implementation.

Indicator 18 : Institutional Capacity - Essential Biodiversity Related Functions

Methodology

How to calculate indicator

Number of essential biodiversity related functions* that the city uses.

* The functions could include the following: biodiversity centre, botanical garden, herbarium, zoological garden or museum, insectarium, etc.

Scoring Range: (based on the CBI user manual)

0 point: No functions
1 point: 1 function
2 points: 2 functions
3 points: 3 functions
4 points: > 3 functions

City Data

The following are the various biodiversity related functions present in the city

- A zoological park called Bengal Safari in close proximity to Siliguri
- The annual North Bengal Flower Show organised by the Siliguri Horticultural Society
- The North Bengal Science Center which has a science museum and planetarium, located on the outskirts of the city

Further, every college within the city also maintains herbaria for the purpose of education although these are not accessible to the general public. Considering the information above, Siliguri will score 3 points for this indicator.

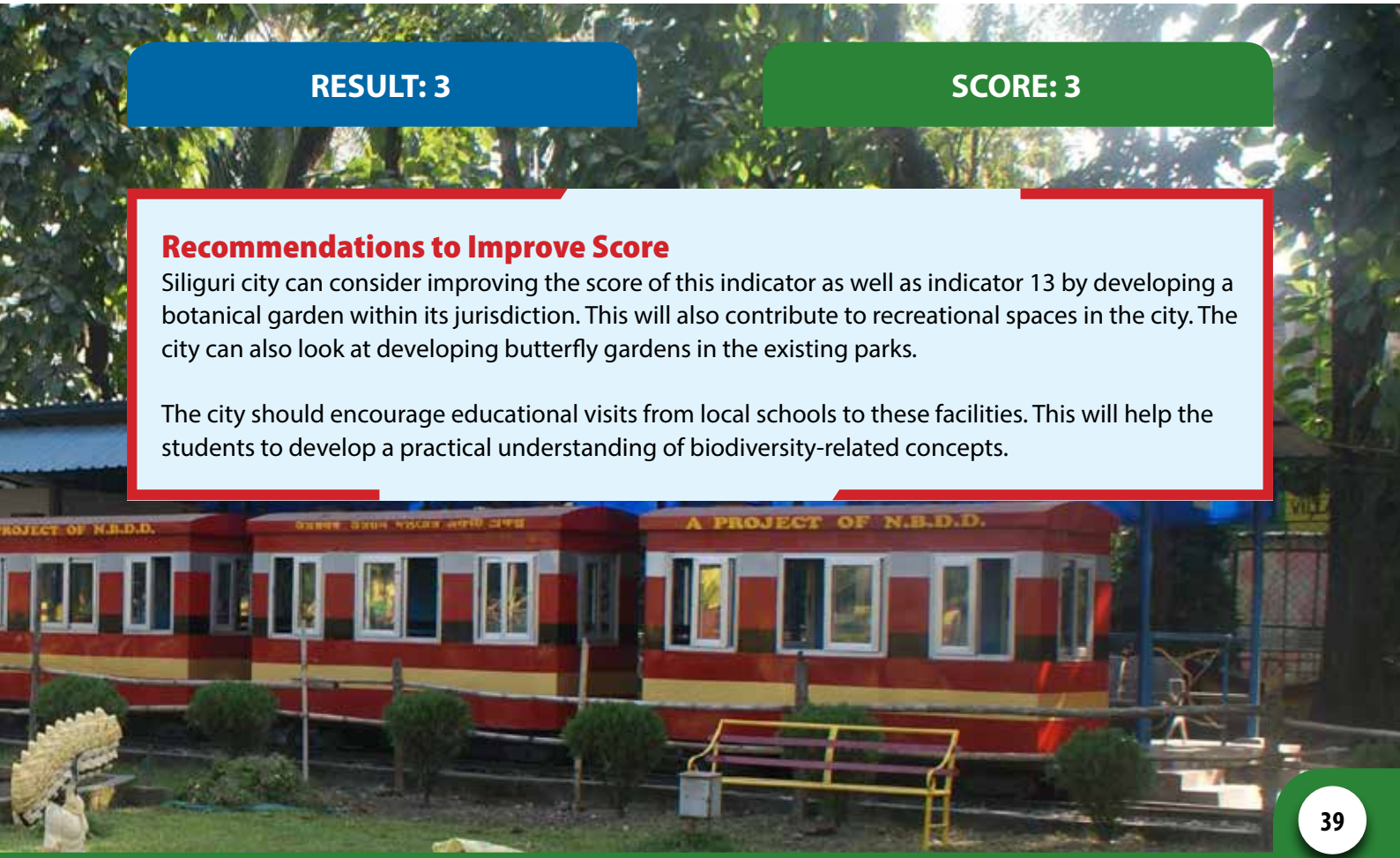
RESULT: 3

SCORE: 3

Recommendations to Improve Score

Siliguri city can consider improving the score of this indicator as well as indicator 13 by developing a botanical garden within its jurisdiction. This will also contribute to recreational spaces in the city. The city can also look at developing butterfly gardens in the existing parks.

The city should encourage educational visits from local schools to these facilities. This will help the students to develop a practical understanding of biodiversity-related concepts.



Indicator 19 : Institutional Capacity - Inter-Agency Co-Operation

Methodology

How to calculate indicator
Number of city or local government agencies involved in inter-agency co-operation pertaining to biodiversity matters.

Scoring Range: (based on the CBI user manual)
0 point: 1 or 2 agencies* cooperate on biodiversity matters
1 point: 3 agencies cooperate on biodiversity matters
2 points: 4 agencies cooperate on biodiversity matters
3 points: 5 agencies cooperate on biodiversity matters
4 points: > 5 agencies cooperate on biodiversity matters

* Agencies could include departments or authorities responsible for biodiversity, planning, water, transport, development, finance, infrastructure, etc.

City Data
There are two main local government agencies which are involved in matters pertaining to biodiversity in Siliguri city. They are:
- Siliguri Municipal Corporation
- Biodiversity Management Committee

RESULT: 2 **SCORE: 0**

Recommendations to Improve Score
To improve this score the city administration can look at establishing an outreach organisation of the corporation, which will function independently. This organisation will assist the city corporation in undertaking and monitoring projects and programmes related to biodiversity conservation. The city can study the example of the Centre for Heritage, Environment and Development (c-hed), established by Kochi Municipal Corporation in this regard.

Indicators 20 : Participation and Partnership - Formal or Informal Public Consultation

Methodology

How to calculate indicator
Existence and state of formal or informal public consultation process pertaining to biodiversity related matters.

Scoring Range: (based on the CBI user manual)

0 point:	No routine formal or informal process
1 point:	Formal or informal process being considered as part of the routine process
2 points:	Formal or informal process being planned as part of the routine process
3 points:	Formal or informal process in the process of being implemented as part of the routine process
4 points:	Formal or informal process exists as part of the routine process

City Data
In the matter of public consultations, the city holds regular formal and informal meetings and it is part of the routine process.

RESULT: Formal or Informal Process Exist

SCORE: 4

Recommendations to Maintain Score

In order to maintain this score, the city should continue to adhere to the robust process of formal public consultations for biodiversity related matters.

Indicators 21 : Participation and Partnership - Institutional Partnership

Methodology

How to calculate indicator
Number of agencies/private companies/NGOs/academic institutions/international organisations with which the city is partnering in biodiversity activities, projects and programmes.

Instances of inter-agency co-operation listed in Indicator 19 should not be listed here again.

Scoring Range: (based on the CBI user manual)

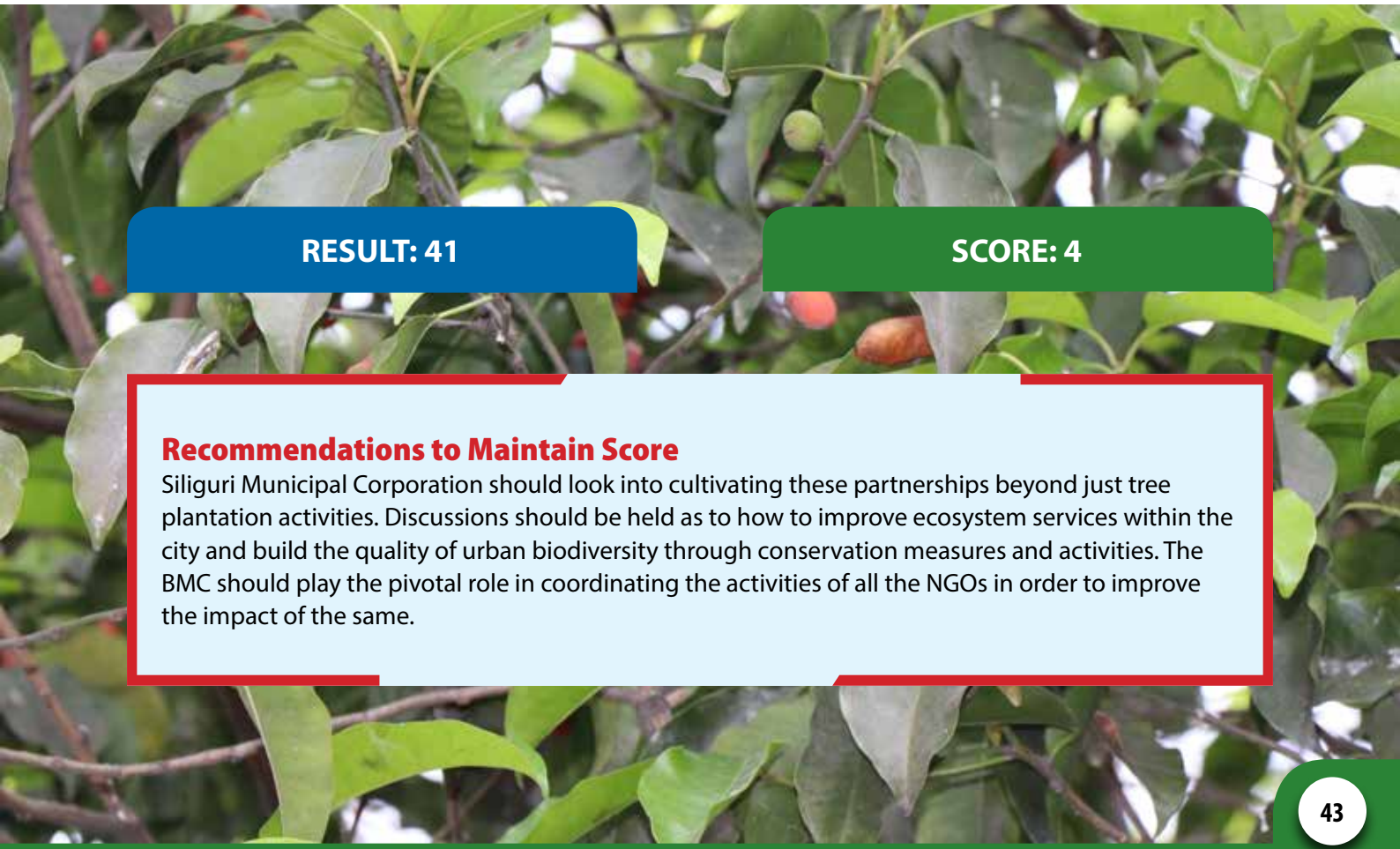
0 point:	No formal or informal partnerships
1 point:	City in partnership with 1-6 other national or subnational agencies/private companies/ NGOs/academic institutions/international organisations
2 points:	City in partnership with 7-12 other national or subnational agencies/private companies/ NGOs/academic institutions/international organisations
3 points:	City in partnership with 13-19 other national or subnational agencies/private companies/ NGOs/academic institutions/international organisations
4 points:	City in partnership with 20 or more other national or subnational agencies/private companies/NGOs/academic institutions/international organisations

City Data
The following are the agencies with whom the city is partnering with in terms of biodiversity related activities, projects and programmes. A large number of the partnerships are to do with tree plantation drives around the city.

1. Swiss Agency for Development and Cooperation is supporting the CapaCITIES Project
2. ICLEI South Asia, South Pole and econcept are implementing the CapaCITIES project
3. CONC'RN
4. Ramakrishna Mission
5. Ramakrishna Vedanta Ashrama
6. Kanchanjungha Uddhar Kendra
7. Indian Red Cross Society
8. Himalayan Nature and Adventure Foundation
9. Siliguri Bigyan Manch
10. All India Namasudra Bikash Parisad
11. Olivia Enlightened Trust
12. Kadamtala Satya Seba Sadan
13. Association For Conservation And Tourism
14. Northern Black Rose Society
15. Siliguri Aranyak
16. Babupara Prachesta
17. People For Animals Siliguri
18. Naboday
19. Saktigarh Sangini Organisation
20. Balason Society For Improved Environment
21. Siliguri Society For Science Technology And Environment

22. Bidhannagar Social Welfare Society
23. Khaprail New Knowledge Society
24. North Bengal Sankalp Foundation
25. Binapani Seva Chakra
26. Siliguri Brikho Pasu Manush Bandhu Samity
27. Niswarth
28. Champasari Mahendra Memorial Welfare Society
29. Shanti Kunj
30. Uttoree Hawa
31. Friend In Need
32. Prothom Khoj Welfare Society
33. Greater Lions Sewa Nidhi
34. Hurrrrey
35. Ei Prajanma
36. The Centre For Terai Development
37. Purvaja Educational Foundation
38. Siliguri Institute For General Notion And Information
39. Himserve
40. Green Lovers
41. Siliguri Welfare Organization

The West Bengal Forest Department operates an office out of Siliguri, - Siliguri Social Forestry Division. This Division in collaboration with SMC ensures tree plantation in otherwise barren lands with an aim to improve the aesthetics of the city and provide a livelihood to the people involved.



RESULT: 41

SCORE: 4

Recommendations to Maintain Score

Siliguri Municipal Corporation should look into cultivating these partnerships beyond just tree plantation activities. Discussions should be held as to how to improve ecosystem services within the city and build the quality of urban biodiversity through conservation measures and activities. The BMC should play the pivotal role in coordinating the activities of all the NGOs in order to improve the impact of the same.

Indicators 22: Education and Awareness - Is Biodiversity or Nature Awareness included in the School Curriculum

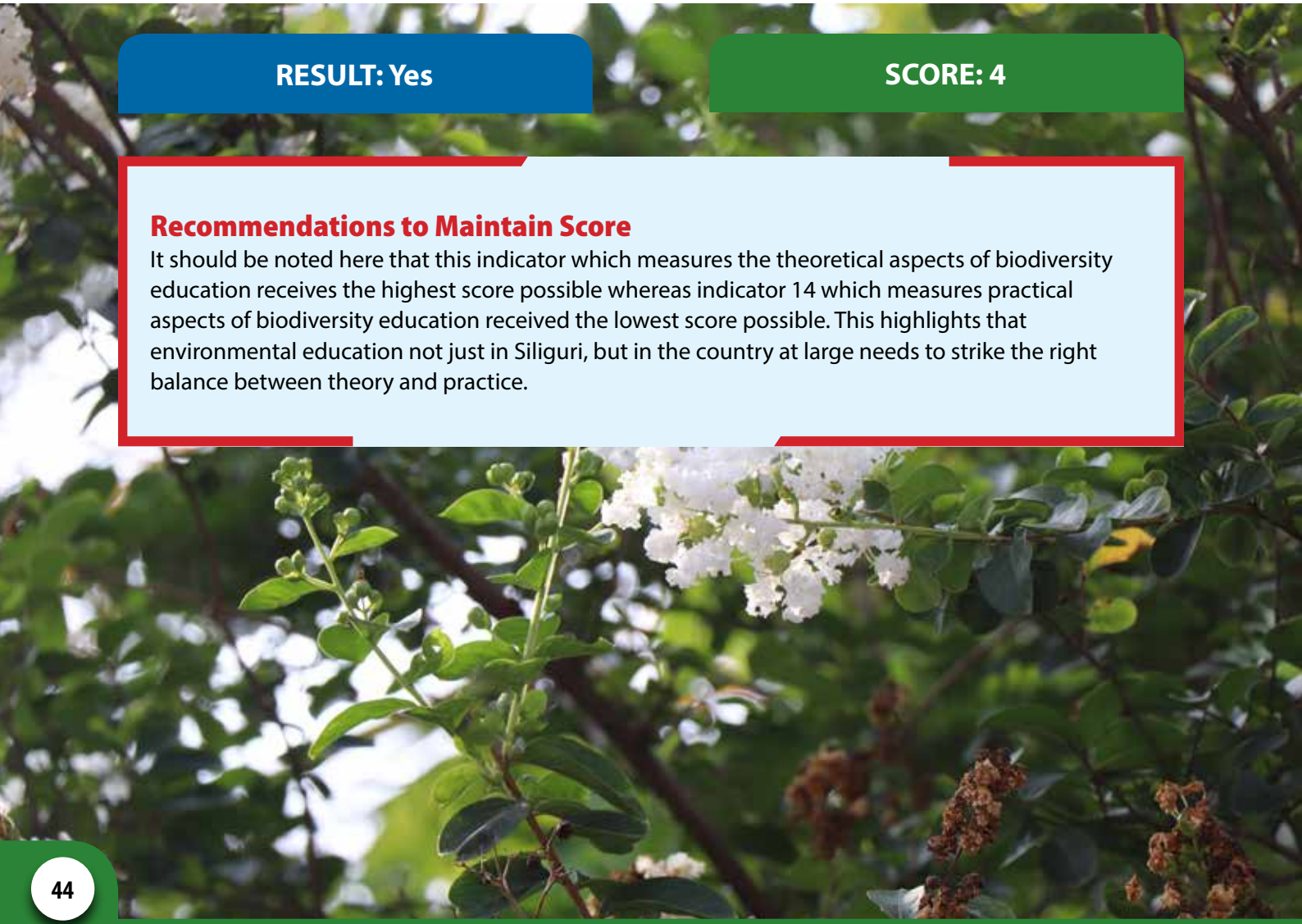
Methodology

How to calculate indicator
Is biodiversity or nature awareness included in the school curriculum (e.g. biology, geography, etc.)?

Scoring Range: (based on the CBI user manual)

0 point:	Biodiversity or elements of it are not covered in the school curriculum
1 point:	Biodiversity or elements of it are being considered for inclusion in the school curriculum
2 points:	Biodiversity or elements of it are being planned for inclusion in the school curriculum
3 points:	Biodiversity or elements of it are in the process of being implemented in the school curriculum
4 points:	Biodiversity or elements of it are included in the school curriculum

City Data
The schools within the city follow the curriculum of various boards such as the West Bengal State Board, Central Board of Secondary Education (CBSE) and Indian Certificate of Secondary Education (ICSE). All of these boards have included biodiversity and nature awareness in various subjects like Biology, Geography, and Environmental Sciences. Therefore, biodiversity or elements of it are included in the school curriculum giving the city a score of 4 points.



RESULT: Yes

SCORE: 4

Recommendations to Maintain Score

It should be noted here that this indicator which measures the theoretical aspects of biodiversity education receives the highest score possible whereas indicator 14 which measures practical aspects of biodiversity education received the lowest score possible. This highlights that environmental education not just in Siliguri, but in the country at large needs to strike the right balance between theory and practice.

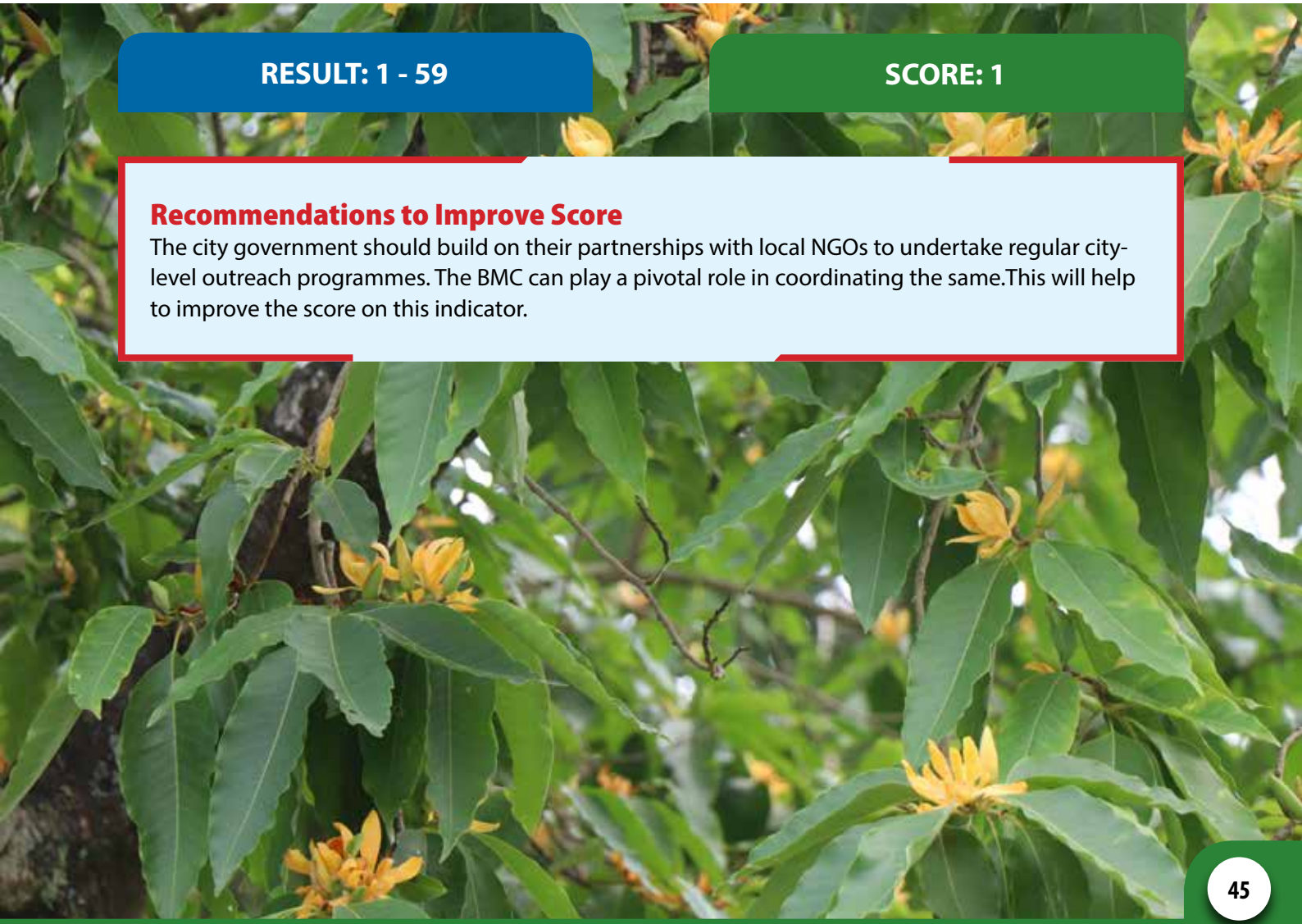
Indicators 23: Education and Awareness - Number of Outreach or Public Awareness Events

Methodology

How to calculate indicator
Number of outreach or public awareness events held in the city per year.

Scoring Range: (based on the CBI user manual)
0 point: 0 outreach events/year
1 point: 1 - 59 outreach events/year
2 points: 60 -149 outreach events/year
3 points: 150-300 outreach events/year
4 points: > 300 outreach events/year

City Data
The major city level biodiversity related programme instituted by the ULB is the World Environmental Day celebration, in addition to other minor programmes throughout the year.. The number of programmes and events organised per year thus falls within the range of 1-59, resulting in a score of 1 point for this indicator.



RESULT: 1 - 59

SCORE: 1

Recommendations to Improve Score

The city government should build on their partnerships with local NGOs to undertake regular city-level outreach programmes. The BMC can play a pivotal role in coordinating the same.This will help to improve the score on this indicator.

Table 13: Summary of the Points

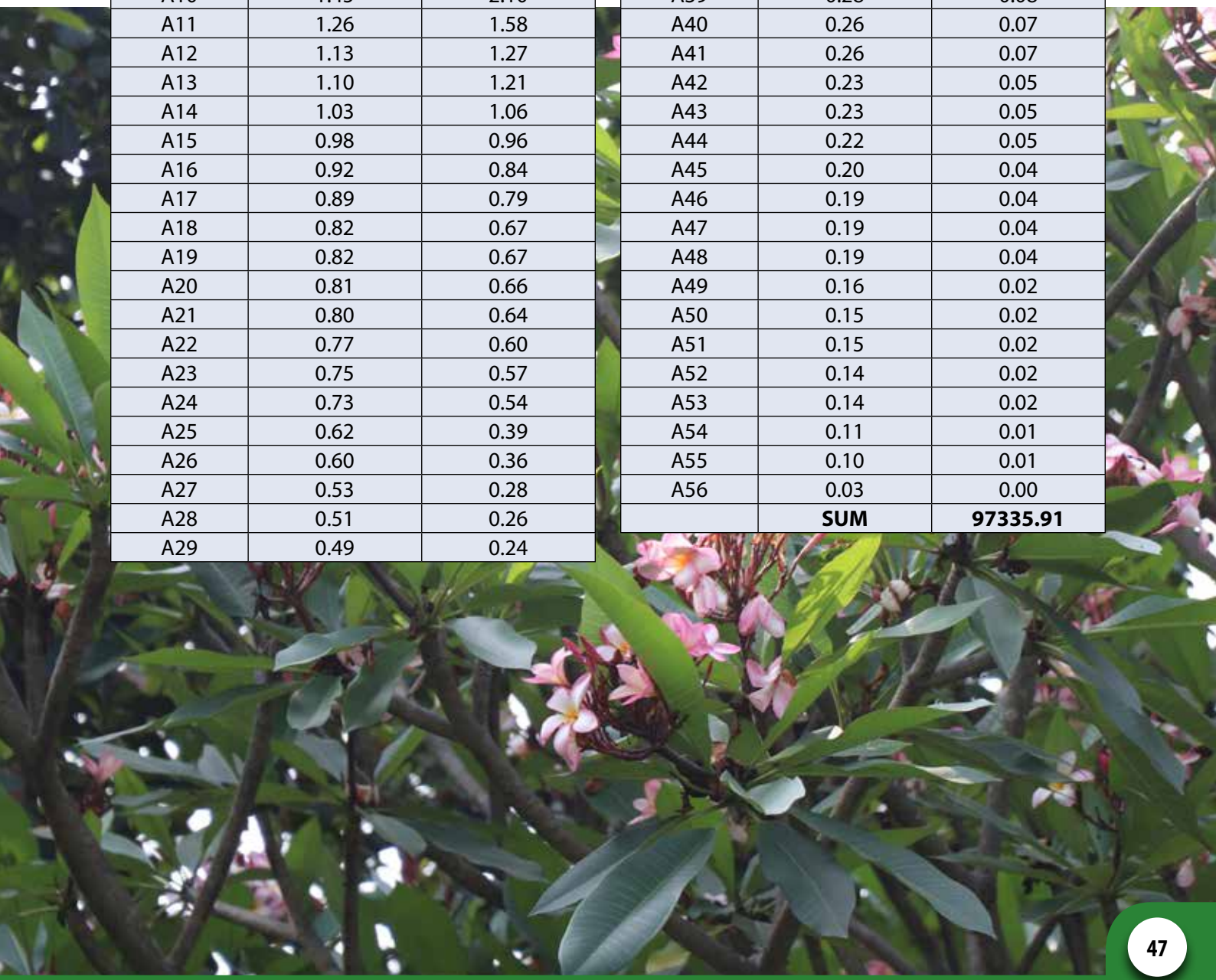
	Maximum Score	Siliguri's Score
Component – Native Biodiversity		
Indicators		
1. Proportion of Natural Areas in the City	4 points	3 points
2. Connectivity Measures	4 points	1 point
3. Native Biodiversity in Built Up Areas (Bird Species)	4 points	4 points
4. Change in Number of Vascular Plant Species	4 points	NA
5. Change in Number of Bird Species	4 points	NA
6. Change in Number of Freshwater fish Species	4 points	NA
7. Change in Number of Species (Odonates)	4 points	NA
8. Change in Number of Species (Amphibians)	4 points	NA
9. Proportion of Protected Natural Areas	4 points	0 points
10. Proportion of Invasive Alien Species	4 points	2 points
Component – Ecosystem Services Provided by Biodiversity		
Indicators		
11. Regulation of Quantity of Water	4 points	2 points
12. Climate Regulation: Carbon Storage and Cooling Effect of Vegetation	4 points	1 point
13. Recreation and Education: Area of Parks with Natural Areas	4 points	2 points
14. Recreation and Education:Number of Formal Education Visits per Child Below 16 Years to Parks with Natural Areas per Year	4 points	0 points
Component – Governance and Management of Biodiversity		
Indicators		
15. Budget Allocated to Biodiversity	4 points	1 point
16. Number of Biodiversity Projects Implemented by the City Annually	4 points	0 points
17. Existence of Local Biodiversity Strategy and Action Plan	4 points	0 points
18. Institutional Capacity: Number of Biodiversity Related Function	4 points	3 points
19. Institutional Capacity: Number of City or Local Government Agencies Involved in Inter-agency Cooperation Pertaining to Biodiversity Matters	4 points	0 points
20. Participation and Partnership: Existence of Formal or Informal Public Consultation Process	4 points	4 points
21. Participation and Partnership: Number of Agencies/Private Companies/ NGOs/Academic Institutions/International Organisations with which the City is Partnering in Biodiversity Activities, Projects and Programmes	4 points	4 points
22. Education and Awareness: Is Biodiversity or Nature Awareness Included in the School Curriculum	4 points	4 points
23. Education and Awareness: Number of Outreach or Public Awareness Events Held in the City per Year	4 points	1 point
Component – Native Biodiversity in the City (Sub-total for indicators 1-10)*		**10 / 20 points***
Component – Ecosystem Services provided by Biodiversity (Sub-total for indicators 11-14)		**5 / 16 points**
Component – Governance and Management of Biodiversity (Sub-total for indicators 15-23)		**17 / 36 points**
Total		**32 / 72 points**

*A total of 20 points for this section is only considered since this is the baseline assessment and hence the indicators 4-8 cannot be considered.

Annexure 1 – Calculation of Connectivity Areas for Indicator 2

Patch ID	Area in ha (patch size)	Area * Area (Sq. h)
A1	310.84	96622.29
A2	25.32	640.92
A3	5.31	28.16
A4	2.46	6.05
A5	2.40	5.76
A6	2.30	5.31
A7	2.30	5.29
A8	1.55	2.39
A9	1.50	2.25
A10	1.45	2.10
A11	1.26	1.58
A12	1.13	1.27
A13	1.10	1.21
A14	1.03	1.06
A15	0.98	0.96
A16	0.92	0.84
A17	0.89	0.79
A18	0.82	0.67
A19	0.82	0.67
A20	0.81	0.66
A21	0.80	0.64
A22	0.77	0.60
A23	0.75	0.57
A24	0.73	0.54
A25	0.62	0.39
A26	0.60	0.36
A27	0.53	0.28
A28	0.51	0.26
A29	0.49	0.24

Patch ID	Area in ha (patch size)	Area * Area (Sq. h)
A30	0.48	0.23
A31	0.46	0.21
A32	0.40	0.16
A33	0.32	0.10
A34	0.31	0.10
A35	0.30	0.09
A36	0.29	0.09
A37	0.29	0.09
A38	0.29	0.08
A39	0.28	0.08
A40	0.26	0.07
A41	0.26	0.07
A42	0.23	0.05
A43	0.23	0.05
A44	0.22	0.05
A45	0.20	0.04
A46	0.19	0.04
A47	0.19	0.04
A48	0.19	0.04
A49	0.16	0.02
A50	0.15	0.02
A51	0.15	0.02
A52	0.14	0.02
A53	0.14	0.02
A54	0.11	0.01
A55	0.10	0.01
A56	0.03	0.00
	SUM	**97335.91**



Annexure 2 – List of Species

Table 14: List of Bird Species used for calculation of Indicators 3 and 5

Sl. No.	Common Name	Scientific Name	Resident	Urban
1	Indian Peafowl	*Pavo cristatus*	Yes	Yes
2	Rock Pigeon	*Columba livia*	Yes	Yes
3	Oriental Turtle-Dove	*Streptopelia orientalis*	Yes	Yes
4	Greater Coucal	*Centropus sinensis*	Yes	Yes
5	Green-billed Malkoha	*Phaenicophaeus tristis*	Yes	No
6	Asian Koel	*Eudynamys scolopaceus*	Yes	Yes
7	Common Hawk-Cuckoo	*Hierococcyx varius*	Yes	Yes
8	Himalayan Swiftlet	*Aerodramus brevirostris*	Yes	Yes
9	House Swift	*Apus nipalensis*	Yes	Yes
10	Asian Palm-Swift	*Cypsiurus balasiensis*	Yes	Yes
11	River Lapwing	*Vanellus duvaucelii*	Yes	No
12	Red-wattled Lapwing	*Vanellus indicus*	Yes	Yes
13	Little Ringed Plover	*Charadrius dubius*	Yes	No
14	Green Sandpiper	*Tringa ochropus*	No	No
15	Common Greenshank	*Tringa nebularia*	No	No
16	Black Stork	*Ciconia nigra*	No	No
17	Little Cormorant	*Microcarbo niger*	Yes	Yes
18	Great Cormorant	*Phalacrocorax carbo*	Yes	No
19	Little Egret	*Egretta garzetta*	Yes	Yes
20	Cattle Egret	*Bubulcus ibis*	Yes	Yes
21	Indian Pond-Heron	*Ardeola grayii*	Yes	Yes
22	Black-headed Ibis	*Threskiornis melanocephalus*	Yes	No
23	Red-naped Ibis	*Pseudibis papillosa*	Yes	No
24	Oriental Honey-buzzard	*Pernis ptilorhynchus*	Yes	No
25	Himalayan Griffon	*Gyps himalayensis*	Yes	No
26	White-eyed Buzzard	*Butastur teesa*	Yes	No
27	Crested Goshawk	*Accipiter trivirgatus*	Yes	No
28	Shikra	*Accipiter badius*	Yes	Yes
29	Black Kite	*Milvus migrans*	Yes	Yes
30	Himalayan Buzzard	*Buteo burmanicus*	Yes	No
31	Asian Barred Owlet	*Glaucidium cuculoides*	Yes	No
32	Spotted Owlet	*Athene brama*	Yes	Yes
33	Eurasian Hoopoe	*Upupa epops*	Yes	Yes
34	Indian Gray Hornbill	*Ocyceros birostris*	Yes	Yes
35	Oriental Pied-Hornbill	*Anthracoceros albirostris*	Yes	No
36	Common Kingfisher	*Alcedo atthis*	Yes	No
37	White-throated Kingfisher	*Halcyon smyrnensis*	Yes	Yes
38	Green Bee-eater	*Merops orientalis*	Yes	Yes

Sl. No.	Common Name	Scientific Name	Resident	Urban
39	Chestnut-headed Bee-eater	*Merops leschenaulti*	Yes	Yes
40	Indian Roller	*Coracias benghalensis*	Yes	No
41	Dollarbird	*Eurystomus orientalis*	Yes	No
42	Coppersmith Barbet	*Megalaima haemacephala*	Yes	Yes
43	Great Barbet	*Megalaima virens*	Yes	Yes
44	Lineated Barbet	*Megalaima lineata*	Yes	Yes
45	Blue-throated Barbet	*Megalaima asiatica*	Yes	No
46	Gray-capped Woodpecker	*Dendrocopos canicapillus*	Yes	No
47	Rufous-bellied Woodpecker	*Dendrocopos hyperythrus*	Yes	No
48	Fulvous-breasted Woodpecker	*Dendrocopos macei*	Yes	Yes
49	Himalayan Flameback	*Dinopium shorii*	Yes	Yes
50	Greater Flameback	*Chrysocolaptes guttacristatus*	Yes	Yes
51	Black-rumped Flameback	*Dinopium benghalense*	Yes	Yes
52	Gray-headed Woodpecker	*Picus canus*	Yes	No
53	Alexandrine Parakeet	*Psittacula eupatria*	Yes	Yes
54	Rose-ringed Parakeet	*Psittacula krameri*	Yes	Yes
55	Red-breasted Parakeet	*Psittacula alexandri*	Yes	Yes
56	Small Minivet	*Pericrocotus cinnamomeus*	Yes	No
57	Long-tailed Minivet	*Pericrocotus ethologus*	Yes	No
58	Scarlet Minivet	*Pericrocotus speciosus*	Yes	No
59	Large Cuckooshrike	*Coracina macei*	Yes	No
60	Black-winged Cuckooshrike	*Coracina melaschistos*	Yes	No
61	Indian Golden Oriole	*Oriolus kundoo*	Yes	Yes
62	Black-naped Oriole*	*Oriolus chinensis*	No	No
63	Black-hooded Oriole	*Oriolus xanthornus*	Yes	Yes
64	Maroon Oriole	*Oriolus traillii*	Yes	No
65	Ashy Woodswallow	*Artamus fuscus*	Yes	No
66	Large Woodshrike	*Tephrodornis gularis*	Yes	No
67	Common Woodshrike	*Tephrodornis pondicerianus*	Yes	No
68	Common Iora	*Aegithina tiphia*	Yes	Yes
69	White-throated Fantail	*Rhipidura albicollis*	Yes	Yes
70	Black Drongo	*Dicrurus macrocercus*	Yes	Yes
71	Ashy Drongo	*Dicrurus leucophaeus*	Yes	Yes
72	Bronzed Drongo	*Dicrurus aeneus*	Yes	Yes
73	Hair-crested Drongo	*Dicrurus hottentottus*	Yes	No
74	Greater Racket-tailed Drongo	*Dicrurus paradiseus*	Yes	No
75	Black-naped Monarch	*Hypothymis azurea*	Yes	No
76	Brown Shrike	*Lanius cristatus*	Yes	Yes
77	Long-tailed Shrike	*Lanius schach*	Yes	Yes
78	Gray-backed Shrike	*Lanius tephronotus*	Yes	Yes
79	Common Green-Magpie	*Cissa chinensis*	Yes	No
80	Rufous Treepie	*Dendrocitta vagabunda*	Yes	Yes
81	Gray Treepie	*Dendrocitta formosae*	Yes	Yes
82	House Crow	*Corvus splendens*	Yes	Yes
83	Large-billed Crow	*Corvus macrorhynchos*	Yes	Yes

Sl. No.	Common Name	Scientific Name	Resident	Urban
84	Gray-headed Canary-Flycatcher	*Culicicapa ceylonensis*	Yes	No
85	Green-backed Tit	*Parus monticolus*	Yes	Yes
86	Cinereous Tit	*Parus cinereus*	Yes	Yes
87	Common Tailorbird	*Orthotomus sutorius*	Yes	Yes
88	Red-rumped Swallow	*Cecropis daurica*	Yes	Yes
89	Nepal House-Martin	*Delichon nipalense*	Yes	Yes
90	Red-vented Bulbul	*Pycnonotus cafer*	Yes	Yes
91	Red-whiskered Bulbul	*Pycnonotus jocosus*	Yes	Yes
92	Himalayan Bulbul	*Pycnonotus leucogenys*	Yes	Yes
93	Black Bulbul	*Hypsipetes leucocephalus*	Yes	No
94	Lemon-rumped Warbler	*Phylloscopus chloronotus*	No	No
95	Tickell's Leaf Warbler	*Phylloscopus affinis*	No	No
96	Dusky Warbler	*Phylloscopus fuscatus*	No	No
97	Whistler's Warbler	*Seicercus whistleri*	Yes	No
98	Greenish Warbler	*Phylloscopus trochiloides*	No	Yes
99	Indian White-eye	*Zosterops palpebrosus*	No	Yes
100	Pin-striped Tit-Babbler	*Macronus gularis*	Yes	No
101	Rufous-capped Babbler	*Stachyridopsis ruficeps*	Yes	No
102	White-browed Scimitar-Babbler	*Pomatorhinus schisticeps*	Yes	No
103	Puff-throated Babbler	*Pellorneum ruficeps*	Yes	No
104	Striated Laughingthrush	*Grammatoptila striatus*	Yes	No
105	Jungle Babbler	*Turdoides striata*	Yes	Yes
106	Chestnut-crowned Laughingthrush	*Trochalopteron erythrocephalum*	Yes	Yes
107	Rufous Sibia	*Heterophasia capistrata*	Yes	Yes
108	Red-billed Leiothrix	*Leiothrix lutea*	Yes	Yes
109	Red-tailed Minla	*Minla ignotincta*	Yes	No
110	Blue-winged Minla	*Siva cyanouroptera*	Yes	No
111	Chestnut-bellied Nuthatch	*Sitta cinnamoventris*	Yes	No
112	Velvet-fronted Nuthatch	*Sitta frontalis*	Yes	No
113	Common Hill Myna	*Gracula religiosa*	Yes	Yes
114	Asian Pied Starling	*Gracupica contra*	Yes	Yes
115	Chestnut-tailed Starling	*Sturnia malabarica*	Yes	Yes
116	Common Myna	*Acridotheres tristis*	Yes	Yes
117	Bank Myna	*Acridotheres ginginianus*	Yes	Yes
118	Jungle Myna	*Acridotheres fuscus*	Yes	Yes
119	Orange-headed Thrush	*Geokichla citrina*	Yes	No
120	Gray-winged Blackbird	*Turdus boulboul*	Yes	No
121	Dark-sided Flycatcher	*Muscicapa sibirica*	No	Yes
122	Asian Brown Flycatcher	*Muscicapa latirostris*	No	Yes
123	Oriental Magpie-Robin	*Copsychus saularis*	Yes	Yes
124	Tickell's Blue Flycatcher	*Cyornis tickelliae*	Yes	Yes
125	Small Niltava	*Niltava macgrigoriae*	Yes	No
126	Rufous-bellied Niltava	*Niltava sundara*	Yes	No
127	Blue Whistling-Thrush	*Myophonus caeruleus*	Yes	Yes
128	Black-backed Forktail	*Enicurus immaculatus*	Yes	No

Sl. No.	Common Name	Scientific Name	Resident	Urban
129	Slaty-backed Forktail	*Enicurus schistaceus*	Yes	No
130	Taiga Flycatcher	*Ficedula albicilla*	No	No
131	Blue-fronted Redstart	*Phoenicurus frontalis*	No	Yes
132	Plumbeous Redstart	*Rhyacornis fuliginosa*	Yes	Yes
133	White-capped Redstart	*Chaimarrornis leucocephalus*	Yes	Yes
134	Blue-capped Rock-Thrush	*Monticola cinclorhynchus*	No	No
135	Blue Rock-Thrush	*Monticola solitarius*	No	Yes
136	Siberian Stonechat	*Saxicola maurus*	No	No
137	Gray Bushchat	*Saxicola ferreus*	Yes	Yes
138	Plain Flowerpecker	*Dicaeum minullum*	Yes	No
139	Purple Sunbird	*Cinnyris asiaticus*	Yes	Yes
140	Green-tailed Sunbird	*Aethopyga nipalensis*	Yes	Yes
141	Crimson Sunbird	*Aethopyga siparaja*	Yes	Yes
142	Asian Fairy-bluebird	*Irena puella*	Yes	No
143	White-rumped Munia	*Lonchura striata*	Yes	No
144	Scaly-breasted Munia	*Lonchura punctulata*	Yes	Yes
145	House Sparrow	*Passer domesticus*	Yes	Yes
146	Eurasian tree sparrow	*Passer montanus*	Yes	Yes
147	Gray Wagtail	*Motacilla cinerea*	No	Yes
148	White-browed Wagtail	*Motacilla maderaspatensis*	Yes	Yes
149	White Wagtail	*Motacilla alba*	No	Yes
150	Paddyfield Pipit	*Anthus rufulus*	Yes	No
151	Olive-backed Pipit	*Anthus hodgsoni*	No	No

Table 15: List of Vascular Plant Species used for calculation of Indicators 4 and 10

Sl. No.	Scientific Name	Habit	Native/ Introduced	Alien Invasive
1	*Abrus precatorius*	Climber	Native	No
2	*Acacia auriculiformis*	Tree	Introduced	No
3	*Acacia catechu*	Tree	Native	No
4	*Acrocarpus fraxinifolius*	Tree	Native	No
5	*Actinodaphne obovata*	Tree	Native	No
6	*Adhatoda vasica*	Shrub	Native	No
7	*Aesculus assamica*	Tree	Native	No
8	*Agave angastifolia*	Herb	Introduced	No
9	*Ageratum conyzoides*	Herb	Introduced	Yes
10	*Ageratum haustonianum*	Herb	Introduced	Yes
11	*Aglaonema crispum*	Herb	Introduced	No
12	*Ailanthus excelsa*	Tree	Native	No
13	*Ailanthus grandis*	Tree	Native	No
14	*Alangium chinense*	Tree	Native	No
15	*Albizia gamblei*	Tree	Native	No
16	*Albizia lebbek*	Tree	Native	No
17	*Albizia lucidior*	Tree	Native	No
18	*Albizia odoratissima*	Tree	Native	No
19	*Albizia procera*	Tree	Native	No
20	*Albizzia lebbek*	Tree	Native	No
21	*Alocasia fallax*	Herb	Native	No
22	*Alocasia macrorrhiza*	Herb	Introduced	No
23	*Aloe vera*	Herb	Native	No
24	*Alpinia nigra*	Herb	Native	No
25	*Alstonia scholaris*	Tree	Native	No
26	*Alternanthera sessilis*	Herb	Introduced	Yes
27	*Alysicarpus vaginalis*	Herb	Native	No
28	*Amaranthus spinosus*	Herb	Introduced	Yes
29	*Amaranthus viridis*	Herb	Native	No
30	*Ammania multiflora*	Herb	Native	No
31	*Amoora spectabilis*	Tree	Native	No
32	*Andrographis paniculata*	Herb	Native	No
33	*Anisomeles indica*	Shrub	Native	No
34	*Annona squamosa*	Tree	Introduced	No
35	*Anthocephalus cadamba*	Tree	Native	No
36	*Aphanamixis polystachya*	Tree	Native	No
37	*Aponogeton spp.*	Herb	Native	No
38	*Araucaria cookii*	Tree	Introduced	No
39	*Araucaria heterophylla*	Tree	Introduced	No
40	*Ardisia solanacea*	Tree	Native	No
41	*Areca catechu*	Tree	Native	No
42	*Argemone mexicana*	Herb	Introduced	Yes
43	*Argyreia roxburghii*	Climber	Introduced	No
44	*Artocarpus heterophyllus*	Tree	Native	No
45	*Artocarpus lakoocha*	Tree	Native	No

Sl. No.	Scientific Name	Habit	Native/ Introduced	Alien Invasive
46	*Asparagus racemosus*	Climber	Native	No
47	*Axonopus compressus*	Herb	Introduced	Yes
48	*Azadirachta indica*	Tree	Native	No
49	*Baccaurea aramiflora*	Tree	Native	No
50	*Bambusa balcooa*	Bamboo	Native	No
51	*Bambusa tulda*	Bamboo	Native	No
52	*Basella rubra*	Climber	Native	No
53	*Bauhinia acuminata*	Tree	Introduced	No
54	*Bauhinia malabarica*	Tree	Native	No
55	*Bauhinia purpurea*	Tree	Native	No
56	*Bauhinia scandens*	Shrub	Native	No
57	*Bauhinia vahlii*	Climber	Native	No
58	*Bauhinia variegata*	Tree	Native	No
59	*Begonia spp.*	Herb	Native	No
60	*Beilschmiedia roxburghiana*	Tree	Native	No
61	*Bidens pilosa*	Herb	Introduced	Yes
62	*Bischofia javanica*	Tree	Native	No
63	*Blumea lacera*	Shrub	Native	No
64	*Boerhavia repens*	Herb	Introduced	No
65	*Bombax ceiba*	Tree	Native	No
66	*Bothriochloa pertusa*	Herb	Native	No
67	*Bougainvillea glabra*	Climber	Introduced	No
68	*Bougainvillea spectabilis*	Climber	Introduced	No
69	*Breynia quadrangularis*	Shrub	Native	No
70	*Bridelia retusa*	Tree	Native	No
71	*Bridelia stipularis*	Shrub	Native	No
72	*Bulbostylis barbata*	Herb	Introduced	No
73	*Butea monosperma*	Tree	Native	No
74	*Butea parviflora*	Shrub	Native	No
75	*Caesalpinia cucullata*	Climber	Native	No
76	*Caesalpinia pulcherrima*	Tree	Introduced	No
77	*Callicarpa arborea*	Tree	Native	No
78	*Callicarpa tomentosa*	Shrub	Introduced	No
79	*Calotropis gigantea*	Shrub	Native	No
80	*Calotropis procera*	Shrub	Native	No
81	*Canarium strictum*	Tree	Native	No
82	*Capsicum annum*	Herb	Introduced	No
83	*Careya arborea*	Tree	Native	No
84	*Carica papaya*	Tree	Introduced	No
85	*Caryota urens*	Tree	Native	No
86	*Casearia graveolens*	Tree	Native	No
87	*Cassia fistula*	Tree	Native	No
88	*Cassia tora*	Herb	Introduced	Yes
89	*Castanopsis hystrix*	Tree	Native	No
90	*Celtis tetrandra*	Tree	Native	No

Sl. No.	Scientific Name	Habit	Native/ Introduced	Alien Invasive
91	*Centella asiatica*	Herb	Native	No
92	*Centranthera humifusa*	Herb	Native	No
93	*Cephalanthus occidentalis*	Tree	Introduced	No
94	*Cestrum nocturnum*	Climber	Introduced	No
95	*Chamabainia cuspidata*	Herb	Native	No
96	*Chromolaena odorata*	Shrub	Introduced	No
97	*Chrysanthemum spp.*	Herb	Introduced	No
98	*Chrysopogon aciculatus*	Herb	Native	No
99	*Chukrasia tabularis*	Tree	Native	No
100	*Cinnamomum glaucescens*	Tree	Native	No
101	*Cinnamomum tamala*	Tree	Native	No
102	*Cissus repanda*	Shrub	Native	No
103	*Citrullus vulgaris*	Climber	Introduced	No
104	*Citrus medica*	Tree	Native	No
105	*Cleome rutidosperma*	Herb	Introduced	Yes
106	*Cleome viscosa*	Herb	Native	No
107	*Clerodendrum infortunatum*	Shrub	Native	No
108	*Clerodendrum viscosum*	Shrub	Native	No
109	*Clitoria ternatea*	Climber	Native	No
110	*Codiaeum variegatum*	Herb	Introduced	No
111	*Colocasia esculenta*	Herb	Native	No
112	*Combretum decandrum*	Climber	Introduced	No
113	*Commelina diffusa*	Herb	Native	No
114	*Commelina suffruticosa*	Herb	Native	No
115	*Cordia oblique*	Tree	Native	No
116	*Costus speciosus*	Shrub	Native	No
117	*Crassocephalum crepidioides*	Herb	Introduced	Yes
118	*Crataeva religiosa*	Tree	Native	No
119	*Crinum defixum*	Herb	Native	No
120	*Crotalaria alata*	Herb	Native	No
121	*Crotalaria juncea*	Herb	Native	No
122	*Crotalaria prostrata*	Herb	Native	No
123	*Crotalaria saltiana*	Herb	Introduced	No
124	*Croton bonplandianum*	Herb	Introduced	Yes
125	*Cryptolepis buchanani*	Climber	Native	No
126	*Cucurbita pepo*	Climber	Introduced	No
127	*Cuphea hyssopifolia*	Herb	Introduced	No
128	*Curculigo orchioides*	Herb	Native	No
129	*Curcuma longa*	Herb	Native	No
130	*Curcuma zedoaria*	Herb	Native	No
131	*Cyanotis axillaris*	Herb	Native	No
132	*Cyanotis vaga*	Herb	Native	No
133	*Cynodon dactylon*	Herb	Introduced	Yes
134	*Cynoglossum lanceolatum*	Herb	Native	No
135	*Cyperus compressus*	Herb	Native	No

Sl. No.	Scientific Name	Habit	Native/ Introduced	Alien Invasive
136	*Cyperus difformis*	Herb	Introduced	Yes
137	*Cyperus iria*	Herb	Introduced	Yes
138	*Cyperus pilosus*	Herb	Native	No
139	*Cyperus pseudokyllingioides*	Herb	Native	No
140	*Cyperus rotundus*	Herb	Native	No
141	*Dactyloctenium aegyptium*	Herb	Introduced	No
142	*Dahlia spp.*	Herb	Introduced	No
143	*Dalbergia latifolia*	Tree	Native	No
144	*Dalbergia rimosa*	Climber	Native	No
145	*Dalbergia sissoo*	Tree	Native	No
146	*Dalbergia stipulacea*	Tree	Native	No
147	*Datura stramonium*	Shrub	Introduced	Yes
148	*Delonix regia*	Tree	Introduced	No
149	*Dentella repens*	Herb	Introduced	No
150	*Desmodium heterophyllum*	Herb	Native	No
151	*Desmodium triflorum*	Herb	Native	No
152	*Dichanthium annulatum*	Herb	Native	No
153	*Dictyospermum album*	Shrub	Introduced	No
154	*Dillenia indica*	Shrub	Native	No
155	*Dillenia pentagyna*	Tree	Native	No
156	*Dioscorea prazeri*	Climber	Native	No
157	*Dombeya matersii*	Shrub	Introduced	No
158	*Dracaena fragrans*	Herb	Introduced	No
159	*Drymaria cordata*	Herb	Introduced	No
160	*Duabanga sonneratioides*	Tree	Native	No
161	*Duranta repens*	Shrub	Introduced	No
162	*Echinocarpus sterculiacea*	Tree	Native	No
163	*Eclipta alba*	Herb	Native	No
164	*Eichhornia crassipes*	Herb	Introduced	Yes
165	*Elaeocarpus floribundus*	Tree	Native	No
166	*Elaeocarpus lanceifolius*	Tree	Native	No
167	*Elaeocarpus sphaericus*	Tree	Native	No
168	*Elephantopus scaber*	Herb	Introduced	Yes
169	*Eleusine indica*	Herb	Native	No
170	*Eleutheranthera ruderalis*	Herb	Introduced	No
171	*Emblica officinalis*	Tree	Native	No
172	*Emilia sonchifolia*	Herb	Introduced	Yes
173	*Endospermum chinense*	Tree	Native	No
174	*Engelhardia spicata*	Tree	Native	No
175	*Enhydra fluctuans*	Herb	Native	No
176	*Entada rheedi*	Shrub	Native	No
177	*Epipremnum aureum*	Climber	Introduced	Yes
178	*Eragrostis gangetica*	Herb	Native	No
179	*Eragrostis nigra*	Herb	Native	No
180	*Eragrostis tenella*	Herb	Native	No

Sl. No.	Scientific Name	Habit	Native/ Introduced	Alien Invasive
181	*Eragrostis tremula*	Herb	Native	No
182	*Eragrostis unioloides*	Herb	Native	No
183	*Eriobotrya bengalensis*	Tree	Native	No
184	*Eriocaulon spp.*	Herb	Native	No
185	*Erythrina indica*	Tree	Native	No
186	*Eugenia jambolana*	Tree	Introduced	No
187	*Euphorbia hirta*	Herb	Introduced	Yes
188	*Euphorbia microphylla*	Herb	Introduced	No
189	*Eurya japonica*	Tree	Introduced	No
190	*Evodia fraxinifolia*	Tree	Native	No
191	*Evolvulus alsinoides*	Herb	Introduced	No
192	*Ficus bengalensis*	Tree	Native	No
193	*Ficus benjamina*	Tree	Native	No
194	*Ficus cunia*	Shrub	Native	No
195	*Ficus elastica*	Tree	Native	No
196	*Ficus hispida*	Shrub	Native	No
197	*Ficus nemoralis*	Tree	Native	No
198	*Ficus racemosa*	Tree	Native	No
199	*Ficus religiosa*	Tree	Native	No
200	*Ficus semicordata*	Tree	Native	No
201	*Fimbristylis aestivalis*	Herb	Introduced	No
202	*Fimbristylis densa*	Herb	Introduced	No
203	*Fimbristylis littoralis*	Herb	Native	No
204	*Fimbristylis ovata*	Herb	Native	No
205	*Firmiana colorata*	Tree	Native	No
206	*Flacourtia jangamas*	Tree	Native	No
207	*Garcinia cowa*	Tree	Native	No
208	*Gardenia jasminoides*	Shrub	Introduced	No
209	*Garuga pinnata*	Tree	Native	No
210	*Glinus lotoides*	Herb	Native	No
211	*Glochidion lanceolarium*	Tree	Native	No
212	*Glochidion thomsonii*	Tree	Native	No
213	*Gmelina arborea*	Tree	Native	No
214	*Gnaphalium purpureum*	Herb	Introduced	No
215	*Grangea maderaspatana*	Herb	Introduced	Yes
216	*Grewia asiatica*	Shrub	Native	No
217	*Grewia serrulata*	Tree	Native	No
218	*Gynocardia odorata*	Tree	Native	No
219	*Gynura cusimbua*	Herb	Native	No
220	*Haldina cordifolia*	Tree	Native	No
221	*Hedyotis corymbosa*	Herb	Native	No
222	*Heliconia rostrata*	Herb	Introduced	No
223	*Heliotropium indicum*	Herb	Native	No
224	*Heteropanax fragrans*	Tree	Native	No
225	*Hibiscus rosa-chinensis*	Shrub	Introduced	No

Sl. No.	Scientific Name	Habit	Native/ Introduced	Alien Invasive
226	*Holarrhena pubescens*	Tree	Native	No
227	*Hydrilla verticillata*	Herb	Native	No
228	*Hydrocotyle sibthorpioides*	Herb	Native	No
229	*Hydrolea zeylanica*	Herb	Native	No
230	*Hygrophila phlomoides*	Herb	Native	No
231	*Hygroryza aristata*	Herb	Native	No
232	*Hymenachne acutigluma*	Herb	Introduced	No
233	*Hymenodictyon orixense*	Tree	Native	No
234	*Hypericum japonicum*	Herb	Native	No
235	*Hyptis capitata*	Shrub	Introduced	No
236	*Hyptis suaviolens*	Shrub	Introduced	Yes
237	*Ichnocarpus frutescens*	Climber	Native	No
238	*Imperata cylindrica*	Herb	Native	No
239	*Ipomoea carnea*	Herb	Introduced	Yes
240	*Ipomoea reptans*	Herb	Native	No
241	*Ixora chinensis*	Shrub	Introduced	No
242	*Jasminum multiflorum*	Climber	Native	No
243	*Jasminum sambac*	Climber	Native	No
244	*Kaempferia rotunda*	Herb	Native	No
245	*Kalanchoe blossfeldiana*	Herb	Introduced	No
246	*Kalanchoe laciniata*	Herb	Introduced	No
247	*Knema erratica*	Tree	Native	No
248	*Kydia calycina*	Tree	Native	No
249	*Kyllinga triceps*	Herb	Native	No
250	*Lagerstroemia flos-reginae*	Tree	Native	No
251	*Lagerstroemia hirsuta*	Tree	Native	No
252	*Lagerstroemia parviflora*	Tree	Native	No
253	*Lagerstroemia speciosa*	Tree	Native	No
254	*Lannea coromandelica*	Tree	Native	No
255	*Lantana camara*	Shrub	Introduced	Yes
256	*Lasia spinosa*	Herb	Native	No
257	*Lemna minor*	Herb	Native	No
258	*Leucas indica*	Herb	Native	No
259	*Limnophila racemosa*	Herb	Introduced	No
260	*Lindernia ciliata*	Herb	Native	No
261	*Lindernia crustacea*	Herb	Native	No
262	*Lindernia parviflora*	Herb	Native	No
263	*Lippia javanica*	Shrub	Introduced	No
264	*Litsea cubeba*	Shrub	Introduced	No
265	*Litsea monopetala*	Tree	Native	No
266	*Lobelia trigona*	Herb	Native	No
267	*Lophopetalum wightianum*	Tree	Native	No
268	*Ludwigia adscendens*	Herb	Introduced	Yes
269	*Ludwigia octavalvis*	Herb	Introduced	Yes
270	*Ludwigia perennis*	Herb	Introduced	Yes

Sl. No.	Scientific Name	Habit	Native/ Introduced	Alien Invasive
271	*Luffa aegyptiaca*	Climber	Native	No
272	*Macaranga sp.*	Tree	Native	No
273	*Maesa indica*	Shrub	Native	No
274	*Magnolia pterocarpa*	Tree	Native	No
275	*Mallotus philippinensis*	Tree	Native	No
276	*Mangifera indica*	Tree	Native	No
277	*Mazus pumilus*	Herb	Native	No
278	*Mecardonia procumbens*	Herb	Introduced	Yes
279	*Meliosma simplicifolia*	Tree	Native	No
280	*Melochia corchorifolia*	Herb	Introduced	Yes
281	*Melothria leucocarpa*	Climber	Native	No
282	*Merremia hirta*	Climber	Native	No
283	*Mesua ferrea*	Tree	Native	No
284	*Michelia champaca*	Tree	Native	No
285	*Michelia montana*	Tree	Native	No
287	*Mikania micrantha*	Climber	Introduced	Yes
288	*Millettia extensa*	Climber	Native	No
289	*Mimosa himalayana*	Shrub	Native	No
290	*Mimosa pudica*	Herb	Introduced	Yes
291	*Mimusops elengi*	Tree	Native	No
292	*Mitracarpus hirtus*	Herb	Introduced	No
293	*Momordica charantia*	Climber	Native	No
294	*Monochoria hastata*	Herb	Native	No
295	*Monochoria vaginalis*	Herb	Introduced	Yes
296	*Monstera deliciosa*	Climber	Native	No
297	*Morinda angustifolia*	Shrub	Native	No
298	*Morus macroura*	Tree	Native	No
299	*Mucuna macrocarpa*	Shrub	Native	No
300	*Mucuna pruriens*	Climber	Native	No
301	*Mukia maderaspatana*	Climber	Native	No
302	*Murdannia nudiflora*	Herb	Native	No
303	*Murdannia spirata*	Herb	Native	No
304	*Murraya koenigii*	Shrub	Native	No
305	*Murraya paniculata*	Shrub	Native	No
306	*Musa paradisiaca*	Tree	Introduced	No
307	*Najas spp.*	Herb	Native	No
308	*Nelsonia canescens*	Herb	Native	No
309	*Neocinnamomum caudatum*	Shrub	Native	No
310	*Neolamarckia cadamba*	Tree	Native	No
311	*Neonauclea griffithii*	Tree	Native	No
312	*Nerium oleander*	Shrub	Native	No
313	*Nyctanthes arbor-tristis*	Tree	Native	No
314	*Nymphaea spp.*	Herb	Native	No
315	*Nymphoides spp.*	Herb	Native	No
316	*Ocimum americanum*	Herb	Native	No

Sl. No.	Scientific Name	Habit	Native/ Introduced	Alien Invasive
317	*Ocimum basilicum*	Herb	Native	No
318	*Ocimum sanctum*	Shrub	Native	No
319	*Oenanthe benghalensis*	Herb	Native	No
320	*Olea dioica*	Tree	Native	No
321	*Oroxylum indicum*	Tree	Native	No
322	*Oxalis corniculata*	Herb	Introduced	Yes
323	*Panicum spp.*	Herb	Native	No
324	*Parthenium hysterophorus*	Herb	Introduced	Yes
325	*Passiflora foetida*	Climber	Introduced	Yes
326	*Peltophorum pterocarpum*	Tree	Introduced	No
327	*Persea fructifera*	Tree	Native	No
328	*Machilus gamblei*	Tree	Native	No
329	*Phoebe lanceolata*	Tree	Native	No
330	*Phyllanthus amarus*	Herb	Native	No
331	*Phyllanthus emblica*	Tree	Native	No
332	*Phyllanthus urinaria*	Herb	Native	No
333	*Physalis minima*	Herb	Introduced	Yes
334	*Pilea microphylla*	Herb	Introduced	Yes
335	*Piper mullesua*	Climber	Native	No
336	*Pisum arvense*	Climber	Introduced	No
337	*Plumeria obtusa*	Tree	Introduced	No
338	*Plumeria rubra*	Tree	Introduced	No
339	*Podocarpus neriifolia*	Tree	Native	No
340	*Polyalthia longifolia*	Tree	Native	No
341	*Polyalthia simiarum*	Tree	Native	No
342	*Polycarpon prostratum*	Herb	Introduced	No
343	*Polygala linarifolia*	Herb	Introduced	No
344	*Polygonum hydropiper*	Herb	Introduced	No
345	*Polygonum microphyllum*	Herb	Native	No
346	*Polygonum orientale*	Herb	Introduced	No
347	*Polygonum plebeium*	Herb	Native	No
348	*Portulaca oleracea*	Herb	Introduced	Yes
349	*Choerospondias axillaris*	Tree	Native	No
350	*Pouzolzia indica*	Herb	Native	No
351	*Premna bengalensis*	Tree	Native	No
352	*Pseudognaphalium luteo-album*	Herb	Native	No
353	*Psidium guajava*	Tree	Introduced	No
354	*Pterospermum acerifolium*	Tree	Native	No
355	*Pterygota alata*	Tree	Native	No
356	*Pterygota sp.*	Tree	Native	No
357	*Pueraria phaseoloides*	Climber	Native	No
358	*Pueraria sikkimensis*	Climber	Native	No
359	*Rauwolfia serpentina*	Shrub	Native	No
360	*Richardia scabra*	Herb	Introduced	No
361	*Ricinus communis*	Shrub	Introduced	No

Sl. No.	Scientific Name	Habit	Native/ Introduced	Alien Invasive
362	*Rikliella squarrosa*	Herb	Native	No
363	*Rorippa indica*	Herb	Native	No
364	*Rosa spp.*	Shrub	Introduced	No
365	*Rotala sp.*	Herb	Native	No
366	*Rubia wallichiana*	Climber	Native	No
367	*Rumex sp.*	Herb	Introduced	No
368	*Rungia pectinata*	Herb	Native	No
369	*Saccharum spontaneum*	Shrub	Introduced	Yes
370	*Salix tetrasperma*	Tree	Native	No
371	*Salomonia ciliata*	Herb	Native	No
372	*Sapindus rarak*	Tree	Native	No
373	*Sapium baccatum*	Tree	Native	No
374	*Triadica cochinchinensis*	Tree	native	No
375	*Saurauja roxburghii*	Tree	Native	No
376	*Schima wallichii*	Tree	Native	No
377	*Schoenoplectus sp.*	Herb	Native	No
378	*Scirpus littoralis*	Herb	Native	No
379	*Scoparia dulcis*	Herb	Introduced	Yes
380	*Semecarpus anacardium*	Tree	Native	No
381	*Sesamum indicum*	Herb	Native	No
382	*Setaria glauca*	Herb	Introduced	No
383	*Shorea robusta*	Tree	Native	No
384	*Sida acuta*	Shrub	Introduced	Yes
385	*Sida cordifolia*	Shrub	Native	No
386	*Sida rhombifolia*	Shrub	Introduced	No
387	*Solanum aculeatissimum*	Shrub	Introduced	No
388	*Solanum diphyllum*	Herb	Introduced	No
389	*Solanum ferox*	Shrub	Native	No
390	*Solanum indicum*	Shrub	Native	No
391	*Solanum khasianum*	Herb	Introduced	No
392	*Solanum nigrum*	Herb	Introduced	Yes
393	*Solanum sisymbrifolium*	Herb	Introduced	No
394	*Solanum torvum*	Shrub	Introduced	Yes
395	*Sonchus asper*	Herb	Introduced	Yes
396	*Spermacoce hispida*	Herb	Introduced	Yes
397	*Spermacoce ocymoides*	Herb	Native	No
398	*Spilanthes acmella*	Herb	Introduced	No
399	*Spondias pinnata*	Tree	Native	No
400	*Sporobolus indicus*	Herb	Native	No
401	*Stephania hernandifolia*	Climber	Native	No
402	*Sterculia villosa*	Tree	Native	No
403	*Stereospermum colais*	Tree	Native	No
404	*Streblus asper*	Tree	Native	No
405	*Swietenia mahagoni*	Tree	Introduced	No
406	*Symplocus cochinchinensis*	Tree	Native	No

Sl. No.	Scientific Name	Habit	Native/ Introduced	Alien Invasive
407	*Syzygium cumini*	Tree	Native	No
408	*Syzygium formosum*	Tree	Native	No
409	*Syzygium nervosum*	Tree	Native	No
410	*Tabernaemontana coronaria*	Shrub	Native	No
411	*Tagetes spp.*	Herb	Introduced	No
412	*Talauma hodgsoni*	Tree	Native	No
413	*Tecoma gaudichaudi*	Shrub	Introduced	No
414	*Tectona grandis*	Tree	Native	No
415	*Terminalia alata*	Tree	Native	No
416	*Terminalia arjuna*	Tree	Native	No
417	*Terminalia bellirica*	Tree	Native	No
418	*Terminalia chebula*	Tree	Native	No
419	*Terminalia myriocarpa*	Tree	Native	No
420	*Tetrameles nudiflora*	Tree	Native	No
421	*Tetrastigma serrulatum*	Shrub	Native	No
422	*Thevetia nerifolia*	Tree	Introduced	No
423	*Thysanolaena maxima*	Herb	Native	No
424	*Tinospora cordifolia*	Shrub	Native	No
425	*Toona ciliata*	Tree	Native	No
426	*Trema orientalis*	Tree	Native	No
427	*Trema tomentosa*	Tree	Native	No
428	*Trewia nudiflora*	Tree	Native	No
429	*Tridax procumbens*	Herb	Introduced	Yes
430	*Triumfetta rhomboidea*	Shrub	Introduced	Yes
431	*Turpinia pomifera*	Tree	Native	No
432	*Urena lobata*	Shrub	Introduced	Yes
433	*Utricularia aurea*	Herb	Native	No
434	*Utricularia bifida*	Herb	Native	No
435	*Vernonia cinerea*	Herb	Native	No
436	*Vinca rosea*	Shrub	Introduced	No
437	*Vitex quinata*	Tree	Native	No
438	*Walsura tubulata*	Tree	native	No
439	*Xanthium strumarium*	Herb	Introduced	Yes
440	*Xylia dolabriformis*	Tree	Native	No
441	*Zanonia indica*	Herb	Native	No
442	*Ziziphus jujuba*	Tree	Native	No
443	*Zizyphus mauritiana*	Tree	Native	No

Table 16: List of Freshwater Fish Species for Indicator 6

Sl. No.	Scientific Name	Local Name
1	*Aspidoparia morar*	Chela
2	*Barilius vagra*	Boroli
3	*Barilius shacra*	Koksa, Na-borna
4	*Chagunius chagunio*	Jerruah
5	*Danio aequipinnatus*	Chebli, Bhitti
6	*Danio dangila*	Nipati
7	*Esomus danricus*	Danrika
8	*Garra annandalei*	Choak-si, Ghor-poia
9	*Garra gotyla*	Budena
10	*Labeo boga*	Bogabata,Bangan
11	*Labeo gonius*	Kurchi, Goni
12	*Labeo pangusia*	Utti
13	*Puntius conchonius*	Kanchan- punti
14	*Puntius gelius*	Gilli-punti
15	*Puntius sarana sarana*	Swornopunti
16	*Puntius phutunio*	Phutuni- punti
17	*Puntius terio*	Teri- punti
18	*Puntius sophore*	Punti
19	*Puntius ticto*	Tita- punti
20	*Raiamas bola*	
21	*Schizothorax richardsonii*	Nak-Katwa, Asala
22	*Tor putitora*	Mahaseer
23	*Balitora brucei*	Tita- Kabri
24	*Schistura beavani*	Pola
25	*Acanthocobitis botia*	Pola
26	*Pangio pangia*	Pangya
27	*Lepidocephalichthys annandalei*	Poa, Poia
28	*Lepidocephalychthys guntea*	Guntel
29	*Somileptes gongota*	Nadiaari Maachh
30	*Mystus bleekeri*	Tengra
31	*Mystus cavasius*	Kabasi tengra
32	*Mystus vittatus*	Tengra, Golsa tengra
33	*Rita rita*	Rita, Reta
34	*Ompok pabda*	Pabda
35	*Ompok pabo*	Pabda
36	*Pangasius pangasius*	Pangas
37	*Bagarius bagarius*	Bagha-ar
38	*Heteropneustes fossilis*	Singhi
39	*Olyra longicaudata*	Bot-singhi
40	*Badis badis*	Bot-koi
41	*Polyacanthus fasciatus*	Kholisa
42	*Pseudambassis ranga*	Chanda
43	*Channa orientalis*	Taki
44	*Channa punctatus*	Taki
45	*Macrognathus pancalus*	Pankal

Sl. No.	Scientific Name	Local Name
46	*Tetraodon cutcutia*	Tepa
47	*Gudusia chapra*	Khoira
48	*Notopterous notopterous*	Pholui
49	*Xenentodon cancila*	Kakla

Table 17: List of Odonate Species for Indicator 7

Sl. No.	Scientific Name	Common Name
1	*Anaciaeschna jaspidea*	Rusty Darner
2	*Anax guttatus*	Blue-tailed Green Darner
3	*Anax indicus*	Lesser Green Emperor
4	*Gynacantha dravida*	Brown Darner
5	*Gynacantha khasiaca*	
6	*Ictinogomphus rapax*	Indian Common Clubtail
7	*Paragomphus lineatus*	Lined Hooktail
8	*Epophthalmia sp.*	
9	*Acisoma panorpoides*	Trumpet Tail
10	*Aethriamanta brevipennis*	Scarlet Marsh Hawk
11	*Agrionoptera insignis*	
12	*Brachydiplax chalybea*	Rufous-Backed Marsh Hawk
13	*Brachydiplax farinosa*	Black-Tailed Dasher
14	*Brachydiplax sobrina*	Little Blue Marsh Hawk
15	*Brachythemis contaminata*	Ditch Jewel
16	*Bradinopyga geminata*	Granite Ghost
17	*Crocothemis servilia*	Scarlet Skimmer
18	*Diplacodes nebulosa*	Black-tipped Ground Skimmer
19	*Diplacodes trivialis*	Blue Ground Skimmer
20	*Hydrobasileus croceus*	Amber-Winged Marsh Glider
21	*Lathrecista asiatica*	Asiatic Blood-Tail
22	*Neurothemis fulvia*	Fulvous Forest Skimmer
23	*Neurothemis intermedia*	Paddyfield Parasol
24	*Neurothemis tullia*	Pied Paddy Skimmer
25	*Orthetrum chrysis*	Brown-Backed Marsh Hawk
26	*Orthetrum glaucum*	Blue Marsh Hawk
27	*Orthetrum luzonicum*	Tri-coloured Marsh Hawk
28	*Orthetrum pruinosum*	Crimson-Tailed Marsh Hawk
29	*Orthetrum sabina*	Green Marsh Hawk
30	*Palpopleura sexmaculata*	Blue-Tailed Yellow Skimmer
31	*Pantala flavescens*	Wandering Glider
32	*Potamarcha congener*	Blue Chaser
33	*Rhodothemis rufa*	Rufous Marsh Glider
34	*Rhyothemis plutonia*	Greater Blue-Wing
35	*Rhyothemis variegata*	Common Picturewing
36	*Tholymis tillarga*	Coral-Tailed Cloudwing
37	*Tramea basilaris*	Red Marsh Trotter
38	*Tramea limbata*	Black Marsh Trotter
39	*Trithemis aurora*	Crimson Marsh Glider
40	*Trithemis festiva*	Black Stream Glider
41	*Trithemis pallidinervis*	Long-Legged Marsh Glider
42	*Urothemis signata*	Greater Crimson Glider
43	*Zyxomma petiolatum*	Brown Dusk Hawk
44	*Neurobasis chinensis*	Stream Glory
45	*Libellago lineata*	River Heliodor

Sl. No.	Scientific Name	Common Name
46	*Aciagrion approximans*	Indian Violet Dartlet
47	*Aciagrion pallidum*	
48	*Agriocnemis clauseni*	
49	*Agriocnemis femina*	Pruinosed Dartlet
50	*Agriocnemis kalinga*	Indian Hooded Dartlet
51	*Agriocnemis lacteola*	Milky Dartlet
52	*Agriocnemis pygmaea*	Pygmy Dartlet
53	*Amphiallagma parvum*	Azure Dartlet
54	*Ceriagrion cerinorubellum*	Orange-Tailed Marsh Dart
55	*Ceriagrion coromandelianum*	Coromandel Marsh Dart
56	*Ceriagrion olivaceum*	Rusty Marsh Dart
57	*Ceriagrion rubiae*	Orange Marsh Dart
58	*Ischnura aurora*	Western Golden Dartlet
59	*Ischnura rufostigma*	
60	*Mortonagrion aborense*	
61	*Paracercion calamorum*	Dusky Lilly-Squatter
62	*Paracercion malayanum*	Malayan Lilly-Squatter
63	*Pseudagrion australasiae*	
64	*Pseudagrion microcephalum*	Blue Grass Dart
65	*Pseudagrion rubriceps*	Saffron-faced Blue Dart
66	*Pseudagrion spencei*	
67	*Lestes praemorsus*	Sapphire-Eyed Spreadwing
68	*Copera marginipes*	Yellow Bush Dart
69	*Onychargia atrocyana*	Black Marsh Dart

Table 18: List of Amphibian Species for Indicator 8

Sl. No.	Scientific Name	Common Name
1	*Duttaphrynus himalayanus*	Himalayan Toad
2	*Duttaphrynus melanostictus*	Common Indian Toad
3	*Euphlyctis cyanophlyctis*	Skittering Frog
4	*Euphlyctis hexadactylus*	Indian Pond Frog
5	*Fejervarya teraiensis*	Terai Cricket Frog
6	*Hoplobatrachus tigerinus*	Indian Bull Frog
7	*Limnonectes mawlyndipi*	Mawlindip Frog
8	*Nanorana annandalii*	Boulenger's Hill Frog
9	*Nanorana arnoldi*	Arnold's Paa Frog
10	*Nanorana blanfordii*	Blanford's Frog
11	*Nanorana chayuensis*	Chayu Spiny Frog
12	*Nanorana gammii*	Gammii Frog
13	*Nanorana liebigii*	Liebig's Frog
14	*Ombrana sikimensis*	Sikkimese Frog
15	*Megophrys glandulosa*	Glandular Horned Toad
16	*Megophrys major*	Great Stream Horned Frog
17	*Megophrys parva*	Brown Horn Frog
18	*Megophrys robusta*	Robust Spadefoot Toad
19	*Microhyla ornata*	Ornate Narrow-mouthed Frog
20	*Amolops formosus*	Assam Cascade Frog
21	*Amolops gerbillus*	Gerbil Stream Frog
22	*Amolops himalayanus*	Himalaya Sucker Frog
23	*Amolops marmoratus*	Marbled Cascade Frog
24	*Amolops monticola*	Mountain Stream Frog
25	*Odorrana chloronota*	Chloronate Huia Frog
26	*Odorrana livida*	Green Cascade Frog
27	*Odorrana mawphlangensis*	Mawphlang Frog
28	*Frankixalus jerdonii*	Jerdon's Bush Frog
29	*Philautus dubius*	Boulenger's Tree Frog
30	*Polypedates teraiensis*	Common Tree Frog
31	*Polypedates maculatus*	Spotted Tree Frog
32	*Raorchestes annandalii*	Annandale's Bush Frog
33	*Rhacophorus bipunctatus*	Double-Spotted Red-Webbed Tree Frog
34	*Rhacophorus maximus*	Günther's Tree Frog
35	*Tylototriton himalayanus*	Himalayan Newt
36	*Tylototriton verrucosus*	
37	*Ichthyophis sikkimensis*	Sikkimese Caecilian

ICLEI - Local Governments for Sustainability, South Asia
C-3, Lower Ground Floor, Green Park Extension, New Delhi - 110016, India
Tel: +91 – 11 – 4974 7200; Fax: +91 - 11 - 4974 7201